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PHILIPS

Let's make things better.

Digital music: free at last!

Digital music. It's been around for some time now, perhaps starting back in the 70s with the old Sony PCM 501, which recorded onto video tape, mainly for studio work. With the advent of the CD though, digital music was made available to the general public, and from there, things just took off. We moved from CD to Digital Audio Tape (DAT), MiniDisc, SACD, MiniDisc (again) and just recently, DVD audio.

But do you notice something? All of these formats relate directly to the media the music is stored on. This raises two distinct problems: One, the encoding system is designed around the limitations of the media, and two, you need to go out and buy a new player each time a new format is released.

Things have changed.

With the rise of the Internet, digital music has moved from being locked into one type of media, to a free-floating file that can be played anywhere. The important repercussions of this change is that you are no longer locked in, and perhaps more appealing, you don't have to go and buy a new player just to keep up. A simple download is often all that's needed to listen to anything from MP3 to ATRAC, to RealAudio, to, well, whatever's next.

Yes digital music is here for good, and that's why we are now devoting a full four pages every month to digital music, in whatever form it takes. We'll have news, reviews, howtos, help and explanations every month, so enjoy!

One last point: I must express my heartfelt apology to the author of our GPS article last month. As many of our readers guessed, it was indeed written by the great Tom Moffat, and we're very sorry that his byline fell off the article. They're famous last words, but *"It'll never happen again, Tom"*.

Graham

Graham Cattley, Editor

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Bulletin Board	Yes, it's still going – 24 hours a day. Call (02) 9353 0627 and have your terminal set up for 8N1			

ON THE COVER

Want to listen to your digital music while on the go? Well, there's no better way to do it than with the Nomad II – reviewed in the first of our monthly digital music features, e-music. Turn to page 16 for all the latest in digital music, MP3, Napster, you name it!

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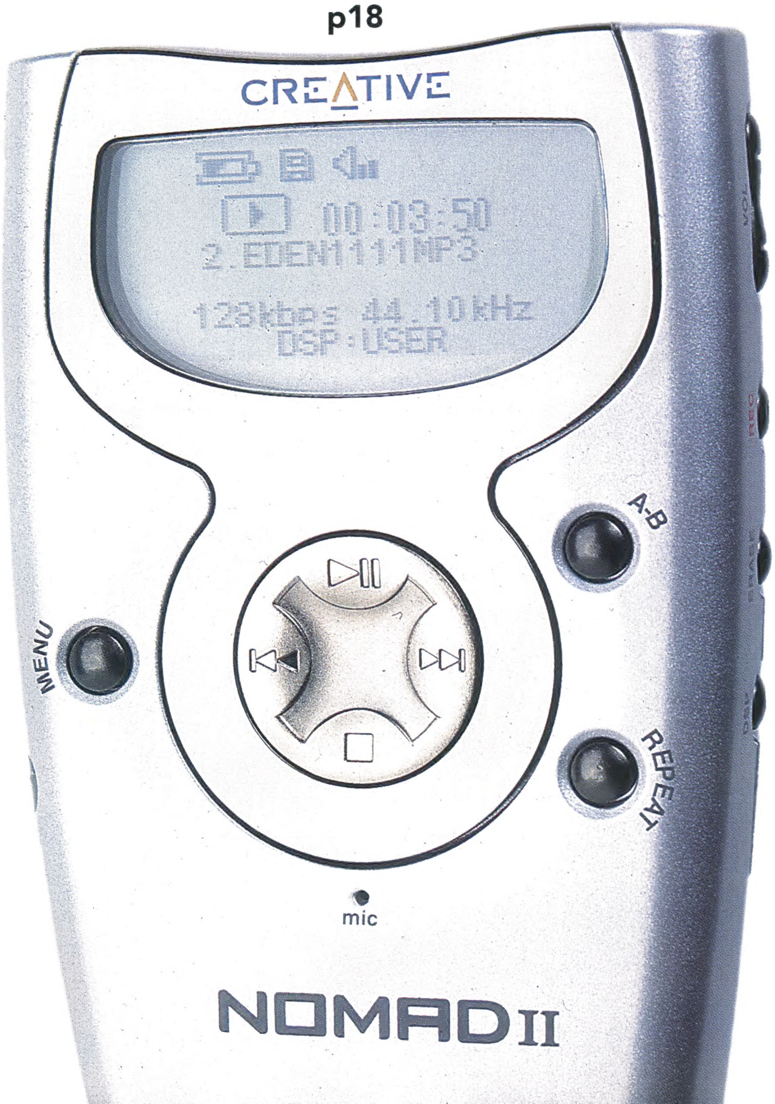

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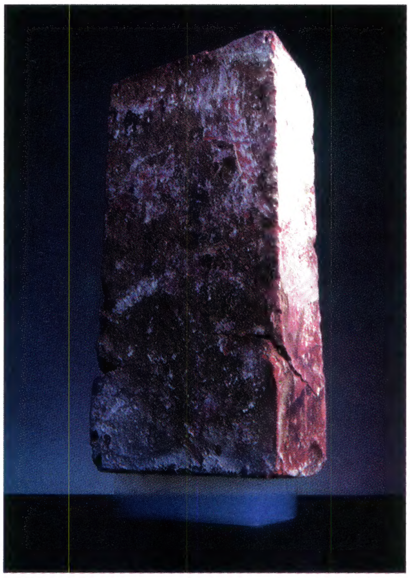
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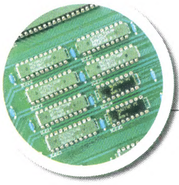


WHAT'S NEW

IN THE EVER CHANGING WORLD OF ELECTRONICS

THIS MONTH

Canon PowerShot Digital Ixus.

Hitachi C29-F200 Super Flat Screen TV.

JVC GR-DVX9 Compact Digital Video Camera.

Panasonic SC-PM22 Micro System.

Olympus Camedia C-920 Digital Camera.

JVC FS-SD9R Compact Stereo System.

Kodak EZ200 Mini Digital Camera.

JVC RV-DP100 Boomblaster Portable.

Dick Smith Electronics D-Cam Digital Camera.

Panasonic Technics SC-DV170 Home Theatre System.

Dick Smith Electronics VCR Co-pilot remote control.

Denon PMA-655 50-50W Amplifier

World's smallest **digital camera**

CANON have just released the remarkable credit card-sized Power Shot Digital Ixus, the smallest zoom lens digital camera in the world.

Measuring 87 x 57 x 26.9mm, Canon's Digital Ixus is approximately the same size as that of the EPLH 2 film camera, launched last year.

A 2.11 megapixel CCD sensor and newly developed 35 — 70mm (35mm camera equivalent) 2x zoom lens with three aspherical lens elements, deliver sharp images with minimized distortion. Three-point AiAF, employing three active focusing points, enables the camera to automatically determine the primary subject, even if it is off-centre, and focus accordingly while the perfectly round aperture produces natural-looking background blur.

A Canon proprietary digital signal-processing IC makes possible fast, high-precision response that, working in tandem with the camera's buffer memory, enables a shutter release time lag of just 0.05 seconds and a shooting interval of a mere 1.7 seconds for stress-free picture taking.

Image data is stored on CompactFlash cards, permitting the storage of up to approximately 46 images on a single 8MB card when shooting in Fine/Small mode.

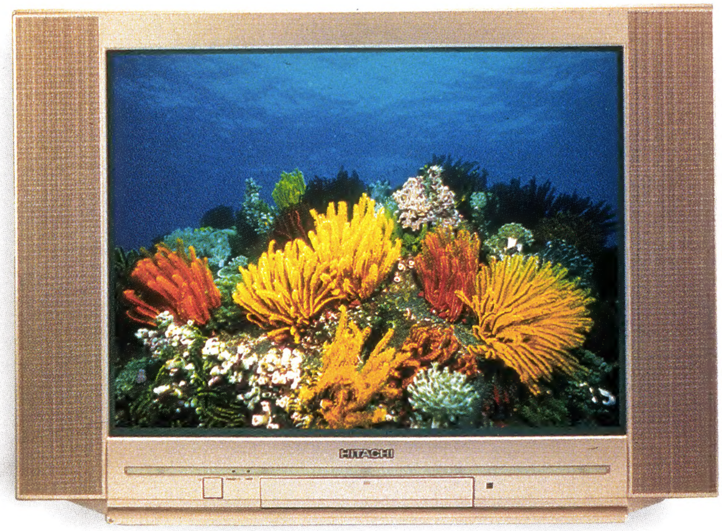
■ *The Canon Digital Camera PowerShot Digital Ixus (which includes an 8MB CompactFlash card, battery pack, battery charger, wrist strap, and video cable) is now available for an RRP of $1399. For further information, call Canon Australia on (02) 9805 2000.*

Superflat **TV**

HITACHI has a new 'Super-Flat' 68cm (29") television that offers superior image quality, advanced digital features and a hifi sound system.

The Hitachi C29-F200 offers the very latest in viewing pleasure with the best in Super-Flat technology offering a clear and distortion free image even in bright, sunlit rooms.The set includes a 200-channel storage facility with automatic system tuning as well as wide frequency coverage including new Hyperband services expected in the future. Channel frequency is specified at 44 to 863MHz, covering PAL, SECAM and NTSC standards.

■ *It's available from all good retailers around Australia at an RRP of $1649, so if you are interested in getting the latest big-screen set, give Hitachi a call on 1800 789 799, or visit their web site at www.hitachi.com.au.*



MiniDV cameras — with sound effects

THESE new compact vertical-type digital video (Mini DV) cameras from JVC are slim enough and compact enough for users to take them just about anywhere.

Both models feature JVC's advanced Progressive Scan with Super Resolution technology, to deliver superior image quality with 520 lines of horizontal resolution and 576 lines of vertical resolution.

In addition, the top-end GR-DVX9 comes with an array of unique digital features especially created to help users make the most of its performance. These include one-touch 'Video Clip' capability — which allows users to create compressed video clips whose small file sizes are ideal for email attachments — as well as a variety of digital sound effects (using MP3) that can be inserted into footage to create more exciting and unique videos.

Users can insert these effects into a DV recording at any time — either during shooting or afterwards during editing. Among the effects provided are: Applause, Cheering, Laughter, Explosion, Buzzer, Siren, and Fanfare. Users can also visit JVC's website and choose from an even wider range of sound effects available for download.

The GR-DVX9 is also equipped with an XGA-capable digital still camera facility with Dual Shooting function that lets users shoot still images while recording motion pictures.

For those who prefer a simpler, easier-to-use camcorder that still delivers fundamental high performance, there's the GR-DVX8. Focusing on high-resolution shooting with Progressive scan CCD, this unit offers the same high performance as the high-end models, but comes with a more selective set of features.

■ *Compact, versatile, and incredibly powerful, these new MiniDV camcorders are ideal for any creative videographer in today's age of mobile multimedia. For more information, contact JVC Consumer Products on 1800 225 044, or visit www.jvc-australia.com.*

Micro systems **with macro sound**

PANASONIC'S new SC-PM03 and SC-PM22 micro component systems include big audio features — such as high-quality CD players and digital synthesiser AM/FM tuners — in a package compact enough to fit on a bookshelf or a bedside table.

The SC-PM22 also includes a bi-amp design to effectively boost bass power. Because it is driven by its own amplifier (as are each of the main speakers), the woofer is able to deliver rich, virtually distortion-free bass, while the main speakers accurately reproduce the mid/high range.

Both systems have high-quality CD players. The CD player on the SC-PM03 features a motorised open-top panel, while the SC-PM22 has a front-loading CD player with one touch play.

Both micro systems contain quartz synthesised digital tuners, so once a station is selected, it won't drift from that frequency. The SC-PM22 also includes a feather-touch, auto-reverse tape deck that offers simple, reliable operation. The tape deck makes quick work of fast forwarding and rewinding to desired tracks with TPS (tape program search).

Both models feature design enhancements. For striking visual appeal, the SC-PM03 and SC-PM22 have a high-quality silver finish, with light oak look speakers and graphical blue LCD displays.

■ *The SC-PM03 is $390 and the SC-PM22 is $556. They are available from leading electrical retailers. For more information contact Panasonic Customer Care on 132 600.*

Silver **Zoom**

THE digital camera market has recently seen the launch of models with two or even three megapixels. Nevertheless, those in the 1-megapixel class continue to enjoy brisk sales. This demand reflects their easy data handling along with outstanding cost performance.

Camedia's C-960 Zoom compact digital camera features a CCD with 1.3 million pixels and a 3x zoom lens. This new release offers easier operation as well as the high-performance functions of its best-selling predecessor model - the CAMEDIA C-920 ZOOM. Even with these advantages, it is priced very affordably.

Building on the design of the earlier C-920 Zoom, the 920 Zoom it has the same functions plus better cost performance, easier operation and superior image quality.

The high-sensitivity 1/2.7 inch CCD — the same one used in the earlier C-920 — has 1.3 million pixels. Finished in a new silver colour, the compact and stylish body holds a number of advanced functions including versatile flash modes. There are fine-tuned adjustments for sharpness, equivalent ISO sensitivity and other settings.

■ *The Camedia C-960 Zoom has an RRP of around $949, and comes with an 8MB SmartMedia card, For further information, contact R. Gunz (Photographic) on (02) 9935 6600, or email gunzmail@gunzphoto.com.au.*

JVC's **Compact sound**

TWO new stylish compact component systems have just arrived from JVC — the FS-SD9R and FS-SD7R. They feature an attractive low-profile centre unit with opaque illumination that gives a sense of class and maturity.

Both the FS-SD9R and FS-SD7R feature cylindrical speaker enclosures with two benefits. One, the circular interior reduces the generation of standing waves that would emphasise a particular frequency range, and two, the round exterior reduces the baffleboard diffraction effect, resulting in smooth horizontal sound spread. Moreover, the FS-SD9R's speakers are finished in real European cherry wood veneer to emulate the natural resonance of acoustic instruments.

Field-proven technologies are applied to the speaker construction. The edgewise-wound 4-layer voice coil using ribbon wire is 20% more space-efficient than typical voice coils, so it can generate higher driving power for more substantial bass. The butyl rubber edge extends bass response thanks to its excellent damping response and the capability to cut spurious sounds. The copper cap on the pole piece reduces harmonic distortion to provide clear mids and highs, and a heavy and rigid diecast aluminium frame provides the speaker unit with an unmoving support so lows are played back with power.

The Active Hyper-Bass PRO Sound System controls the range of the boost frequencies through feedback according to output level. As a result, it's capable of dynamic bass response and clear vocals, with no drop in the midrange response.

Both CD players are equipped with a one-bit D/A converter and digital output for digital-to-digital dubbing convenience.

■ ***The FS-SD7 sells for $659, and the FS-SD9 for $769. Both systems have COMPU PLAY for one-touch power-on and play, and a subwoofer output for connection of an exclusive add-on subwoofer. For further information contact: JVC Consumer Products on 1800 225 044 or visit www.jvc-australia.com.***

Behold, the Boomblaster!

JVC are introducing the new Boomblaster — a special treat for aspiring DJs. The RV-DP100 inherits JVC's tradition of tubular portables, created with emphasis on deep, solid bass that you feel rather than hear, whether you're at home or on the street.

This year, the Boomblaster comes with a suite of music-making features. It has a built-in guitar amp to let you play along with a CD or cassette, as well as two standard input jacks for a guitar and a mic, each with its own level control. Also available is a set of 36 rhythms to play or sing with. Oh, and there are drum pads and rhythm patterns for guitarists, and scratch effects to enhance your DJ style...

The RV-DP100 features a 4-drum pad with five different drum combinations — 20 sound samples in all. The scratch jog offers two types of effects simulating a stylus scratching the surface of an analogue record, so it's a cinch for you to play the DJ you've always wanted to be.

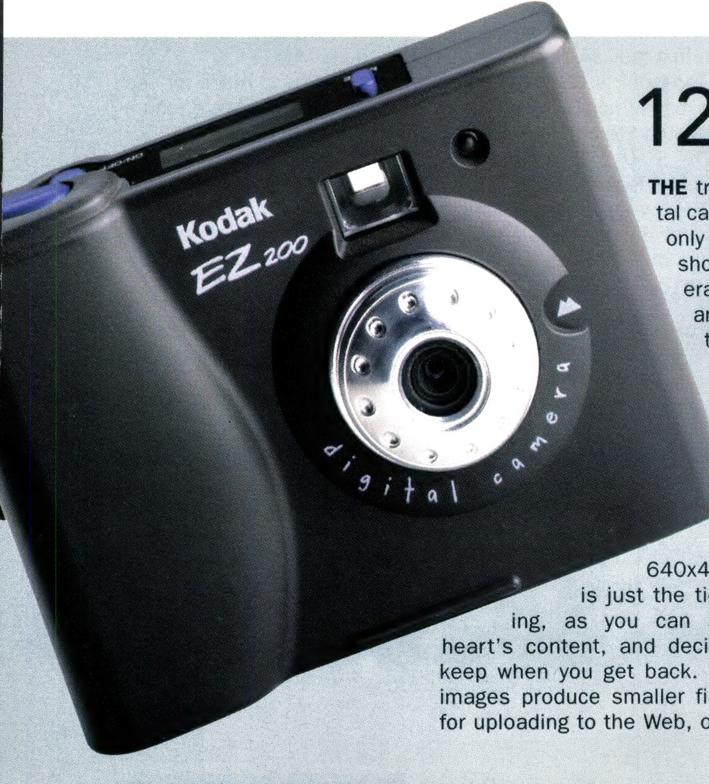
Thumping rock-bottom bass is the Boomblaster's forte, so the RV-DP100 features a number of technologies to support it. There are dual 16cm powered superwoofers driven by exclusive superwoofer amps, in addition to the standard 8cm full-range units powered by two more amps — power is a massive 42W total.

The superwoofers are mounted back-to-back inside to cancel out spurious vibrations: helped by the Super Twin Long Ducts, they deliver crisp, extended bass with high radiation efficiency. A 6-layer voice coil lowers the lowest resonance frequency and increases driving power.

The RV-DP100 is also electronically designed to deliver deep, clean bass sound. The Super Exciter Bass Circuit provides deep, rich bass by shifting inaudibly low frequencies into the audible range and mixing them with the boosted original sound. And ACS (Active Clear Sound) improves clarity for better balance between highs and lows, enhancing the music overall.

The built-in CD player has a one-bit D/A converter and 20-track programming, the cassette deck features full-logic control and auto-reverse, and the digital tuner offers 30 FM and 15 MW/LW preset stations.

■ *The RV-DP100 is also equipped with a shoulder strap with a remote-control case. For more information, contact JVC Consumer Products on 1800 225 044, or visit www.jvc-australia.com.*



128 shots? **It's easy!**

THE trouble with most digital cameras is that you can only take a dozen or so shots before the camera's memory is full, and the images have to be downloaded into a computer.

Kodak's new EZ200 Digital Camera has 4MB of internal memory which can store a whopping 128 pictures at 640x480 resolution, which is just the ticket for a day's outing, as you can snap away to your heart's content, and decide which images to keep when you get back. The lower resolution images produce smaller files, and are perfect for uploading to the Web, or sending via e-mail.

The EZ200 not only allows computer users to take and share images, but also capture short video clips. This versatile device also doubles as a PC Video Camera for videoconferencing.

Images can be easily downloaded to a computer through the supplied USB cable, and you can also connect the camera through the USB cable to transform the EZ200 into a PC Video Camera. When hooked up through its USB connection, there's no battery drain in PC Video Camera mode as power is drawn via the USB cable.

The EZ200 is light and compact, measuring 92 x 36.5 x 68.6mm, and weighing only 134gm, which allows users to take it almost anywhere.

■ *The EZ200 is powered by four (included) AAA batteries, and comes with 4Mb of internal memory, wrist strap, a detachable camera base, 9-foot USB cable and software. It is available through retailers, camera dealers, catalogues and traditional computer channels with an expected street price of $299. For additional information, visit Kodak on the web at: www.kodak.com.*

IBM develops

Linux-based wristwatch

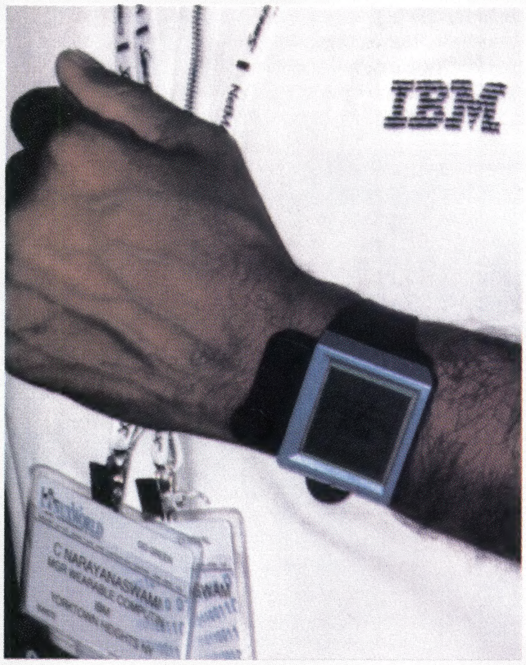
IN A TEST PROJECT to design the smallest possible Linux operating system kernel, IBM's engineers have built a prototype Linux-based wristwatch that also received pages and some e-mail. The device was displayed at the Linux World Expo held in San Jose in August.

The 1.5-ounce device, IBM said, was "designed to communicate wirelessly with PCs, cell phones and other wireless-enabled devices. The 'smart watch' will have the ability to view condensed email messages and directly receive pager-like messages."

IBM spokeswoman Takako Yamakura added that IBM has no plans to bring a Linux watch to market. "Our view is more of an enterprise view than a consumer gadget view. This is just a research prototype. Some say Linux cannot be scaled down. This is just to show Linux is capable of doing this."

Linux is increasingly seen as a potential competitor to Windows CE, for running a broad range of devices from Internet appliances to TV set top boxes. The Open Source nature of the Linux OS provides engineers with the maximum flexibility in designing new products.

"Several benefits accrue from the use of Linux in small pervasive devices. The availability of source code and a well-understood application programming environment makes it easy for students, researchers, and software companies to add new features and develop applications", Yamakura said.



Your own Cray supercomputer

PITTSBURGH Supercomputing Center officials have taken online auctions to a new height by offering their Cray Y-MP C90 supercomputer on the popular online Internet auction site, eBay.

The machine is offered at a minimum bid of US$35,000, which perhaps not coincidentally, is slightly more than the amount they would have to pay Cray Research to remove the machine. Nevertheless, the officials claim that the supercomputer would be a "steal" at that price.

"It's still a fine machine in many respects, and there is a little twinge of sadness in seeing it go off to the glue factory," explained Michael Schneider, science writer at the Monroeville-based center, where the Cray machine has been housed since it was first installed in 1993.

According to the eBay description, the Cray was involved in "heavy-duty number crunching" during its years of operation, and was used for "award-winning scientific calculations by researchers nationwide ... including modeling the beating of the human heart, the impact of the comet Shoemaker-Levy 9 with Jupiter and the demonstration of improved smog reduction strategies." The center has to make room for the new Compaq supercomputer, thanks to a $45 million grant from the National Science Foundation.

The Cray Y-MP C90 contains 16 vector processors (each capable of one 'gigaflop' of processing power), a main memory equivalent to four gigabytes, and has more than 130 gigabytes of high-speed disk storage – we're unsure of its Quake 3 framerate performance though...

Photo lab vending machines

IN A NEW joint venture called Digital Portal Inc, SanDisk Corporation and Photo-Me International will manufacture self-vending digital photo labs for digital camera users.

The booths will be the world's first silver halide processing self service kiosks, and are setup to read user's digital film flash memory cards, floppy disks or CD ROMs. Using the same high quality silver halide process as used in conventional 1 hour print services, the kiosks use a fully-interactive interface for print selection and offer potential picture resolution of 15 million pixels.

Digital Portal Inc promises that the print price will closely match that of existing 1 hour services, however with the kiosk, the first 4 x 6 print will appear in less than three minutes with an additional fifteen seconds for each subsequent print - web connectivity is also planned.

Serge Crasnianski, chief executive officer of Photo Me, said, "We believe that the two companies have the desire and experience to bring digital photography to the millions of people who haven't yet used a digital camera. The digital photography market has barely started, and we expect that Digital Portal will play a major role in accelerating the sale of digital cameras and flash memory cards."

Both companies anticipate that the kiosks, once widely deployed, will quickly become popular because they will accept virtually any storage media used in digital cameras today including CompactFlash and SmartMedia cards, MultiMediaCards, Secure Digital cards, the Memory Stick, floppy disks and CD ROMs.

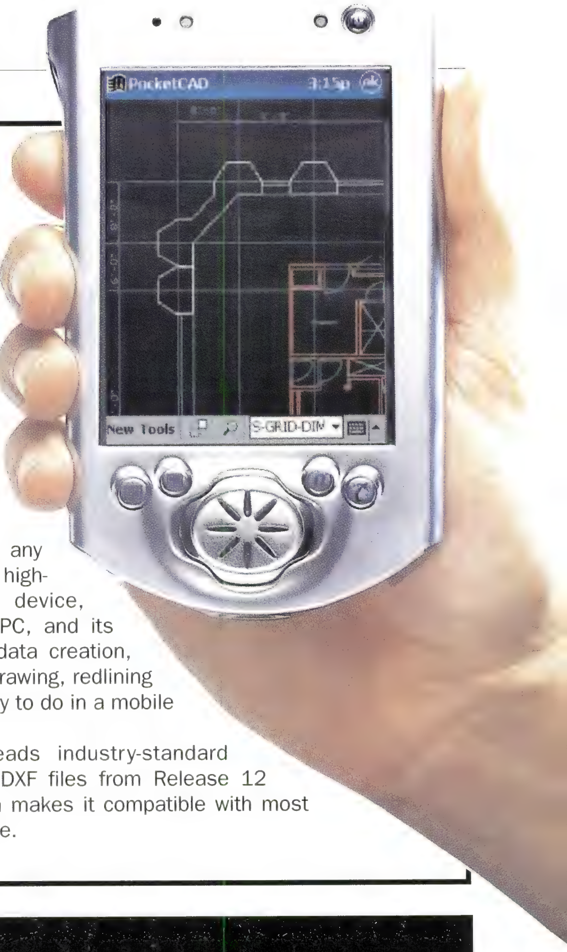
Oops, sweaty Palms

IT WAS bound to happen sooner or later. The first virus affecting the Palm handheld computers has appeared on the Internet, in the guise of an update for a popular shareware program that lets users download and play games made for the Nintendo GameBoy.

In what appears an unintentional release, a virus infected version of 'Palm.Liberty.A' by Gambit Studios has been doing the rounds over the Relay Chat, a network of Internet chatting channels. When run on a Palm, the Trojan Horse virus deletes all of the device's programs leaving just the basic address book, calendar and other database information intact.

Strangely, the source of the virus is reported to be Aaron Ardiri, a member of the Swedish software development team who wrote the original Liberty program. Ardiri apparently created the program to delete unwanted Palm software without harming a user's data, but made the mistake of giving an early version to several friends. Unfortunately, one of them posted it on an Internet Relay Chat channel without Ardiri's knowledge – the current state of their friendship is unknown.

CAD in your pocket



ARC SECOND INC. have released PocketCAD PRO, a fully functional CAD program developed for the rapidly growing number of Pocket PC users. It is compatible with any Windows CE 2.11 or higher-powered mobile device, such as the PocketPC, and its feature set makes data creation, collection, viewing, drawing, redlining and modification easy to do in a mobile environment.

The software reads industry-standard AutoCAD DWG and DXF files from Release 12 through 2000, which makes it compatible with most desktop CAD software.

Red faces at Intel – again

INTEL HAS RECALLED its new 1.13MHz Pentium III processor in order to fix a problem that could cause some applications to lock up. This follows in the wake of their 820 chipset motherboard recall, the delayed release of the low-end Timna chip, and performance issues with its upcoming high-end Itanium processor.

The problem appears to have become apparent when hardware review websites such as Tom's Hardware Guide (**www.tomshardware.com**) put the 1.13GHz processor – Intel's fastest ever – through its paces. After finding serious instability problems and receiving a limited response from Intel themselves, Dr. Thomas Pabst of the respected Tom's Hardware Guide came to the conclusion that "Something is wrong with Intel's new Pentium 1.13GHz processor."

The resulting recall coincides with Advanced Micro Devices (AMD) announcing shipments of their 1.1GHz Athlon, and industry analysts are suggesting that competition with AMD may have forced Intel to release a chip that wasn't ready. "It sounds like Intel may have pushed a little too hard," said chip analyst Peter Glaskowsky of MicroDesign Resources. "It shows the Pentium III is not really capable of reaching these levels."

At this stage the only main players selling systems with the 1.13GHz Intel chip have been Dell and IBM, both of which have stopped shipping PCs based on the new processor. Intel is helping the companies honour any customer warranty issues; "If they want a refund, we'll accommodate them" said Intel spokesman Howard High. "Clearly if they want a replacement, then we will replace (it)"

Meanwhile it must be all smiles at AMD, who seem to be on a roll with their Athlon and Duron processors. Their 1.1GHz processors is receiving excellent reviews, is available now, and appears to be making Intel trip over it's own feet...

Letters

ADC clarification

Having read Daniel Beyer's letter last month (regarding May's Experimenting with Electronics column on ADCs), I have to agree that he is right to some extent.

My explanation of how the 4-bit ADC circuit works was too brief and on some grounds incorrect. However, his assertion that the maximum frequency is 1/32 of the clock frequency isn't strictly correct either.

The real answer lies somewhere in between — and it's determined by, of all things, the amplitude of the sampled waveform.

Daniel's assertion is only correct at maximum frequency and maximum amplitude. However if the amplitude change is only in the order of one-bit, the ADC will match it in one clock cycle. If it's two bits, it will take a maximum of four clock cycles and so on. That means that the maximum frequency of the signal sampled then depends on the relative amplitude change of that signal.

I agree with Daniel that in order to handle the full range of the ADC, the sampling frequency needs to be 32 times higher than the highest frequency of the signal to be sampled.

The benefit of this is that it actually makes designing a low-pass filter for say the audio frequency range that much easier because the clock rate is much higher. Even a simple four-component second-order low-pass RC filter will knock down the clock frequency by some 60dB.

Darren Yates (via email)

Cerberus concern

I am rather upset by some points made in a news article in August EA.

In the article titled 'New remote monitor enhances safety control at level crossings', it describes the Cerberus level crossing monitor system developed by my staff here at Rail Services Australia, which is installed at several hundred level crossings across New South Wales, and was the winner of the 1998 Australian Transport Industry award.

The article incorrectly attributes the development of the system to Call Direct Solutions when, in fact, that company's only involvement has been to supply a very small number of cellular telephone interfaces. Your article has done a great disservice both to the engineers who developed the world-class Cerberus system, and to Rail Services Australia.

Paul Szacsvay
Rail Services Australia. (via email)

Electronics Australia Reader Services

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PHOTOCOPIES:	When back issues are exhausted, photocopies of articles can be supplied. The price is $7.50 per project or $15 where a project spreads over several issues.
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PROJECT QUERIES:	Advice on projects is limited to postal or email correspondence only and to projects less than ten years old. The price is $7.50. PLEASE NOTE that we cannot undertake special research or advise on project modifications. Members of our technical staff are not available to discuss technical problems by telephone.
OTHER QUERIES:	Technical queries outside the scope of the project advice detailed above, or submitted without fee, may be answered in the Information Centre pages at the discretion of the Editor.
BULLETIN BOARD:	Yes, we run a BBS as well. The number is (02) 9353 0627, and it is ANSI compatible, accessible 24 hours a day and supports any rate to 28.8kb/s.
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To understand why $6,843 is a fair price to pay for VAF kit speakers, read 580 words from a violinist who can't use a screwdriver.

The following is an excerpt from a review which appeared in Audio Video Lifestyle Consumer Guide '99 by Sian O'Neale.

"Phillip Vafiadis is the creative talent behind the brand and his aim with VAF Research is to market kit loudspeakers of uncompromising quality at the serious end of the hi-fi market.

The VAF range is priced from $312 a pair right up to $8,863 a pair*, so we're talking serious money here for serious equipment.

We at AVL magazine have been particularly impressed with DC-X series.

These kit loudspeakers are not the standard packages from consumer electronics stores. In fact, you won't find these products in any store. The company prefers to cut out the middle-men and save buyers money, so every product is available factory-direct.

The VAF Signature series includes the Signature 1-66 and 1091 loudspeakers. Taking delivery of the 120kg 1-66 floorstanding speakers is something of an experience; I have never seen such an imposing crate for a pair of loudspeakers before. Fortunately my brother Crispin is capable with the screwdriver and we took out the massive 1-66s. You will need quite a bit of muscle and help to unpack these speakers and get them where you want them. The engineering and attention to finish that has gone into these fully assembled VAF Research 1-66s is simply awesome.

These elegant but powerful looking loudspeakers come with removable velcro attached grilles in a 3-way design; a 210mm hard paper bass driver with solid copper phase plugs and a 25mm double chamber sonotex dome tweeter with a pure silver wire voice coil. Turn the speakers around and you have very high quality gold plated binding posts which allow for bi-wiring and tri-wiring.

The same meticulous attention to detail and build quality also goes into the smaller 1-91 models, three of which are presented as left and right rear surrounds and a centre channel speaker for home theatre use (which has a custom-designed grille for a centre channel speaker). But the 1-91 loudspeakers have been designed to also perform as high quality studio monitors with the same superb sound as the 1-66s.

The speakers were designed to be used close to a rear wall and that's how customers use them, ideally 15cm-40cm from the nearest wall. But I think the speakers sound better when they can breathe more easily. Find the right position for the room and you will be richly rewarded.

The big VAFs deliver a stunning soundstage which is wonderfully insightful and involving. Large scale orchestral works have a level of depth and accuracy that only the best loudspeakers can manage.

As a violinist, I am often left unimpressed with the sound of the violin through so many loudspeakers (even high-end models), but here the presentation is accurate and engrossing. Instrument separation between different members of the orchestra is faultless.

This is particularly obvious when listening to Hans Zimmer's evocative soundtrack for The Thin Red Line in which quiet, gentle music provides so much power and atmosphere.

As a system for home theatre, together with the smaller satellite 1-91s, VAF has assembled an incredible system. Bass extension from the 1-66s is awesome; deep and thrilling, which is ideal for action blockbusters such as Speed, Twister or Titanic (you don't just watch the ship sink - you feel it through the floorboards). The centre channel speaker locks dialogue firmly into place and steers the sound with maximum impact; dialogue in Speed comes across as frantic as the driving. Full marks."

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* Figures amended to reflect current pricing.

For the entire transcript of this review or information on our 14 models contact VAF Research and ask for your copy of "What the Critics Say". Free call 1800 818 882. Email vaf@vaf.com.au or surf www.vaf.com.au

VAF Research 52-54 North Terrace, Kent Town, South Australia 5067

VAF RESEARCH

Built by us. Sold by us.

e-music

your guide to digital music

NEWS

■ Single and online
With any luck, by this time next month, Warner Brothers will be selling singles over the net. Warner, with its family of labels including Rhino, Elektra, Atlantic and London-Sire, will be working with RealNetworks to deliver the music in a number of file formats. The singles will be available only over the net, and will initially include a select range of bands including Manhattan Transfer, Barenaked Ladies and Collective Soul. Warner will then expand the selection to over 1000 singles, from a range of albums from other artists. Warner recently won an undisclosed amount from MP3.com in it's big copyright-infringement suit, but, you guessed it, none of the artists concerned received a cent of the payout. Check out timewarner.com for their side of the story...

■ Napster up, CDs up too
Despite the number of Napster users increasing by over 350% in recent months, CD sales in the US have risen to an all-time high with the RIAA announcing that 420 million units sold in the first half of 2000.
This amounts to a 6% increase on the same period last year, with the RIAA attributing the increase to a healthy market and a large number of successes earlier in the year. These included hits by 'N Sync, Eminem and ▶

NEW STUFF

Expanding experience

▲ Philips have said that we should be getting their Expanium EXP101 pretty soon now – by Christmas, even. The Expanium is an MP3 player that reads songs burned to CD, as well as playing your ordinary music CDs too. So if you want 10 hours of music, with the ability to play old-fashioned CDs as well, head off to www.expanium.philips.com where you can read all about it. If you want to be kept up to date, email tom.lewis@philips.com who will let you know when it is released – and perhaps how much. Current rumours are around the $500 mark.

More in store

▲ DigMedia's MusicStore Jukebox has a 6.4GB hard drive that stores the MP3 files automatically generated when you play a CD in the device. Music can be played through your hifi or PC speakers, or transferred to the MusicStore's little SoulMate personal player at high speed – a couple of seconds per song.

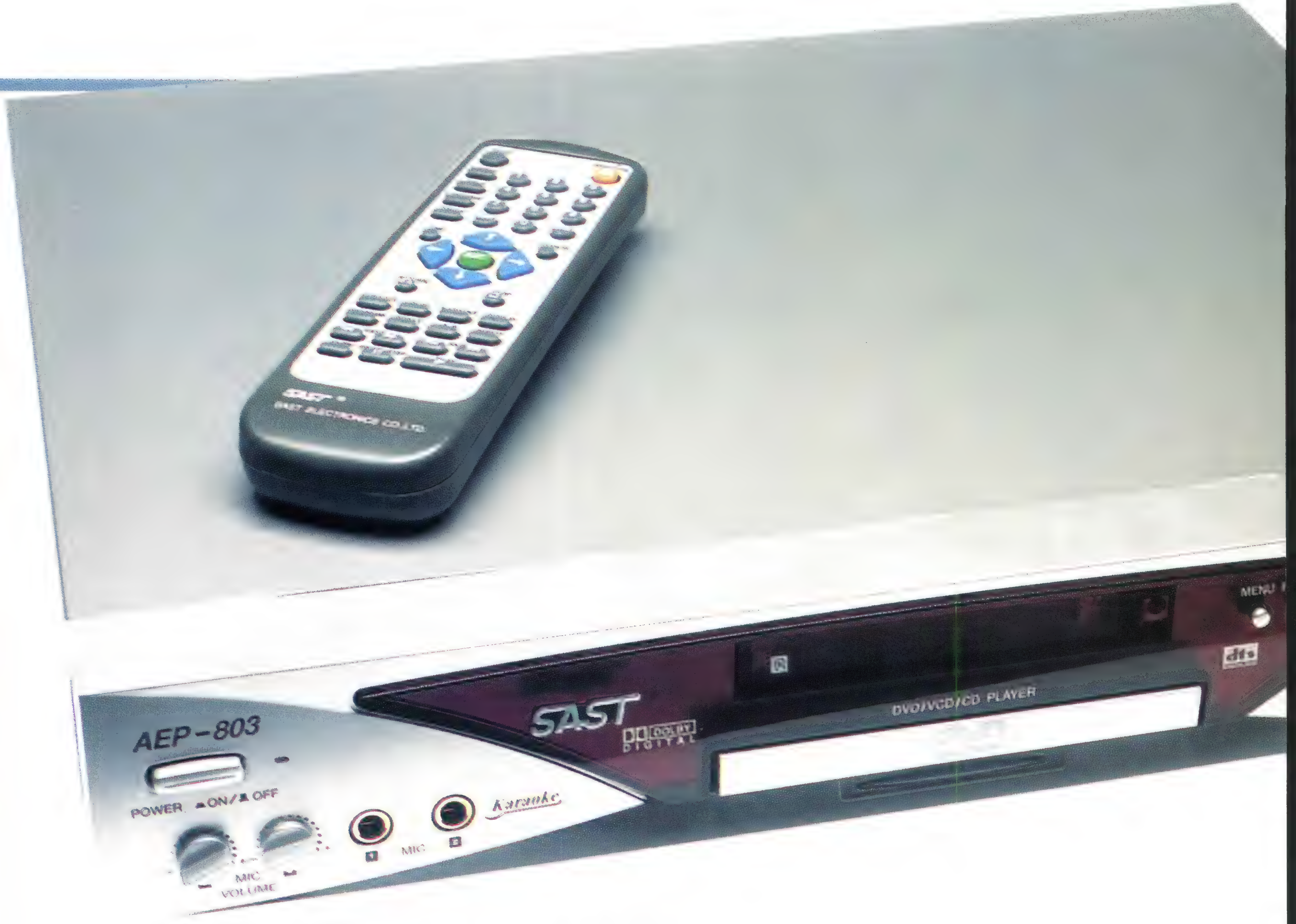
Once the song is transferred, it can't be played on the MusicStore until the SoulMate is returned to base – this is supposed to be some form of digital rights management system, but quite how they justify ripping every CD you play is beyond us. It sells for US$499, and it might make it over to this side of the world early next year.

Radical Rio

▲ The new Rio 600 is here, and boy, is it looking good. It's a long way improved from it's PMP300 and 500 cousins, with a flash new curvy look, and a sophisticated feel. It uses USB so it's nice and fast uploading your songs, and you can get extra coloured faceplates for it so it can match your mood, or mobile phone... the price is $399, and it should be available now from just about any major electrical retailer. Look for a full review next month!

Jumping Jukebox

▲ It looks like a CD player, but it ain't. Creative's new Nomad Jukebox has an internal 6GB hard drive for storing all your MP3s, and a nice large display to scroll through the thousands of songs and playlists you can store on it. With a bit of luck, you'll get over 100 hours of music compressed onto the 400g player, and you can play it back with the usual DSP equalisation options as well as through a unique variable speed function that lets you understand the lyrics. At $1119, they're selling out fast, but if your local electrical retailer is out of stock, they should be able to order them in. www.nomadworld.com/products/jukebox is the place to go for more info.



SAST AEP-803
DVD/CD/MP3 Player

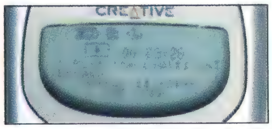
Competition is really starting to heat up in the local DVD player market, with a number of models now available for less than $500. What sets this new model apart from the others? Well, it's the first sub-$500 player to feature a built-in Dolby Digital surround sound decoder...

By Jim Rowe

OK, YOU'VE PROBABLY never heard of SAST Electronics before — I know I hadn't, before getting this new DVD player to review. It turns out that they're one of the largest hi-tech enterprises in mainland China, based in the city of Shenzhen. Ranked in the top 100, they employ about 1000 technicians in the design and manufacture of optical disc players and electronics, and have not only ISO 9000 certification but also very impressive annual production figures: about three million video CD players, five million VCD decoder boards and one million DVD players.

They've actually been producing DVD players since 1997, and were the first firm in China to make them. So the fact that *we* may not have heard of SAST until now probably says more about the relatively slow start of DVDs here, than it does about the company and its products.

In any case, SAST's products *are* available here now, thanks to local importer and distributor

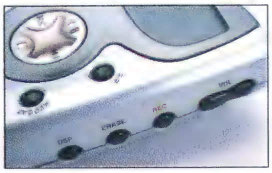


Menu:

The menu is a series of six icons on the screen, each with a couple of sub-menus. Navigation is a bit tricky until you realise that the down, left and right buttons move the cursor down, left and right, but up selects the item highlighted. There's a temptation to keep the down button pressed to scroll down a list of options, but this instead switches off the player, which is infuriating.

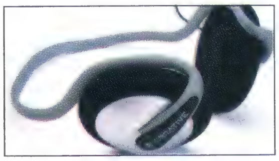
Recording:

Voice mode is selected as a menu item, and recording started with the Rec button on the right side of the player.



DSP:

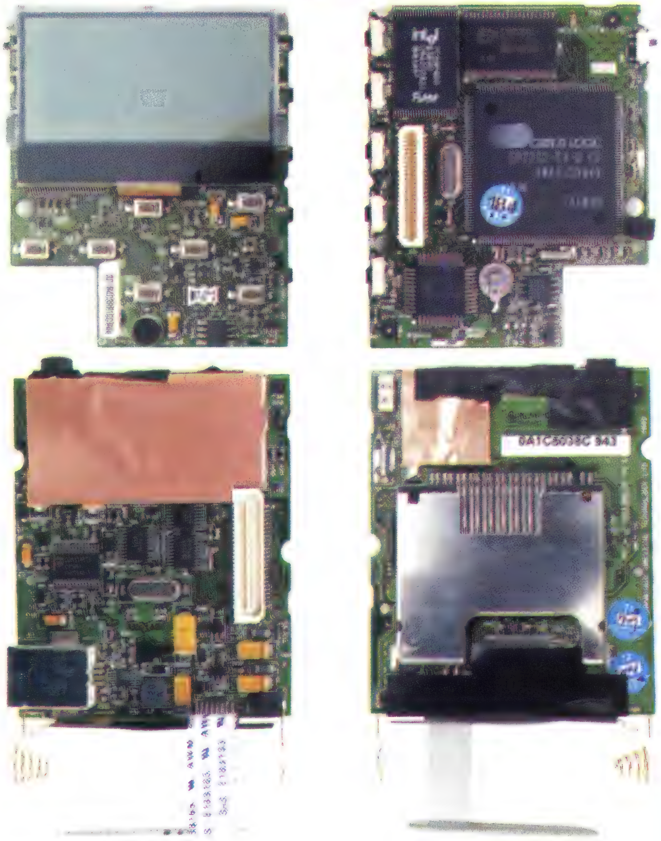
Normal (Flat), Pop, Rock, Classic, Jazz, and User (Bass and Treble adjustable over a 0 - 30 range).



Headphones

Well, if we had to sum them up in one word, we'd have to say that they were 'funky'. Looks aside though, they aren't the easiest things to wear if you don't have closely cropped hair. And if you have larger than average ears, they can get a mite painful too. The sound quality is excellent, and so they get the thumbs up on that point alone.

WHAT'S INSIDE



Scalpel, please...

True to form, when ever we get something new here at EA we pull it to bits. In this case, the Nomad II went under the knife and the results are rather pretty, don't you think?

Look carefully and you should be able to identify all the main parts like RAM, processor/CPU, LCD display, special decoder chips, flashcard socket and USB connector. Note the copper shielding around the Nomad's radio section, and the 'tail' which is the connector to the Nomad's optional docking station.

Formats:

MP3 (as you would expect), and WindowsMedia format available via firmware upgrade from the Creative Nomad Website.

Physical:

93 x 65 x 21mm, 88g with battery

Price: $809

Website:

www.nomadworld.com

Available:

Major electrical retailers, and up to the end of October, you should get a free docking station too.

What's in a name?

Quite a lot, actually. Here's some of the more popular audio formats you'll find around.

MPEG, Layer 3 (MP3) The one we all know and love.

RealAudio (RAM, or .RA) A lower-quality format used mainly for streaming audio directly off a website.

Windows Media Audio (WMA) Microsoft's own format, rivalling MP3.

Advanced Audio Compression (AAC, or simply MP4) This, and Sony's ATRAC3 are formats similar to that used in MiniDiscs.

NEWS

▸ US$4.5 billion to US$10 billion. While this results in larger profits for the manufacturers, Intel is beavering away to try and keep up with the demand. "We will be producing four times the megabytes of flash that we produced in 1999," said Ron Smith, general manager of Intel's wireless computing group "We are adding the equivalent of one factory a quarter." Let's hope it's enough.

■ **Back to Rio**

We've just heard from Rio, and they seem to be pretty busy with a number of extras for their new Rio 600... We pressed them for details, and they let slip that there are a couple of extra backs waiting in the wings.

As well as a standard 64MB back (which really should have been supplied as standard), we should soon see a new drive that takes $20 mini optical discs. Yes, that's right, a micro optical drive that gives you 500MB of MP3s, built right in to the Rio's back. With any luck, it should be available in time for Christmas, but no promises.

There's also word of a Microdrive back, using one of IBM's mini hard drives (see the Professional Electronics section in EA last month). Details are sketchy at the moment, but we'll let you know when they appear.

There's also the new Nike player coming soon from Rio, more info as it come to hand.

NEWS

▶ Britney Spears, so I suppose we have something to thank her for... On the down side, cassette sales fell 31.5% (surprise, surprise), while the number of CD singles sold also fell — and nobody knows why.

■ **Give us MP3!** Whether Napster is seen as friend or foe in the digital music industry, it's had a major effect on the sales of personal music players. "Napster has created a lot of enthusiasm around this market," said Mike Reed, vice president of marketing for S3's Rio division. "It demonstrated that people want access to digital music online. I hope to see a lot of ways for people to get digital music online in the next year. The more access to digital music, the more this segment grows."
And it's not only the MP3 player manufacturers that are cashing in on the boost in popularity of digital music. Manufacturers of CD-ROM burners and even desktop PCs are seeing a rise in sales, as the troubles with Napster and mp3.com increase the public's awareness (and use) of downloaded music.

■ **Gone in a Flash** Inside every MP3 player is memory, and lots of it. With most players offering 64MB of storage, there is a danger that we might run out of Flash memory in late 2001.
Already prices are going up, with sales this year expected to climb from ▶

Review: Nomad II Digital Music Player

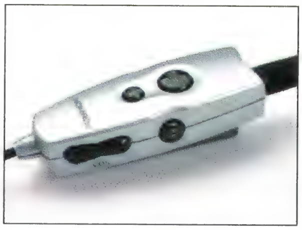
The Nomad II has been hailed as the best MP3 player on the market at the moment, and looking at it's list of features, it is hard to argue. With its gunmetal highlights and streamlined exterior, the Nomad II is a very professional looking beast. It is compact, solidly built, and well designed, and with its oh-so-trendy earphones it certainly won't be out of style for some time to come.

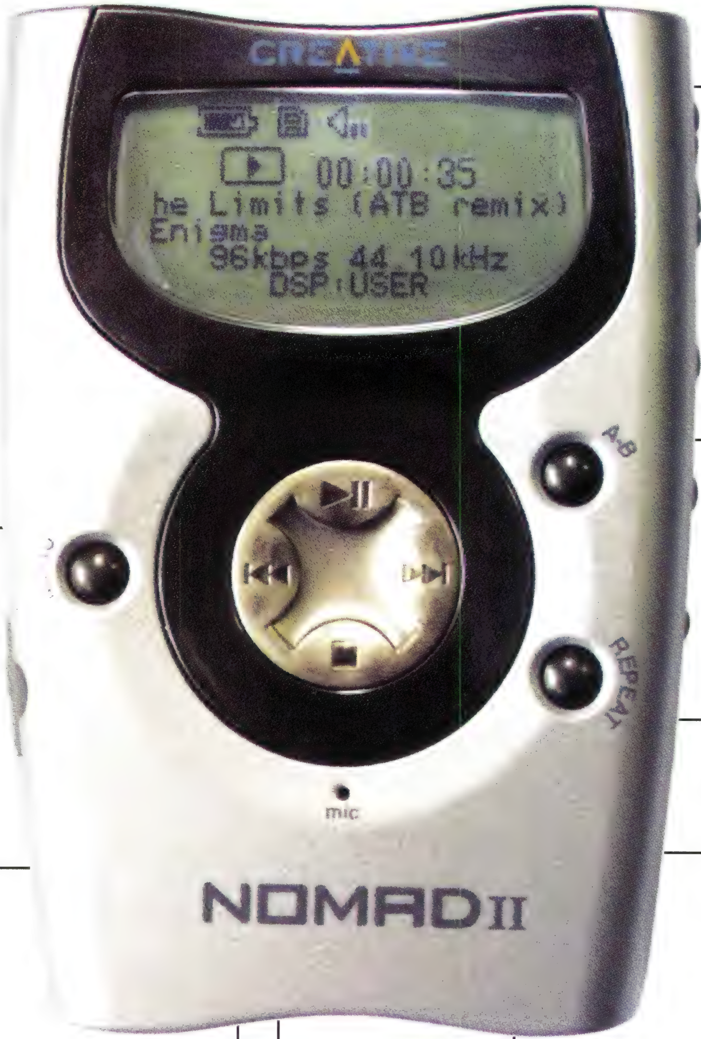
No, the Nomad is perfect in all respects except one: price. At $809, you would have to be very serious about your music to buy one, but if you do, you won't be disappointed.

Controls:

Traditional four-way central button for Play/pause, FF/Next track, RW/Last track, and Stop/Off, with A-B (section loop) and repeat mode buttons on the front face of the player. DSP, Erase, Voice Record and Volume controls on the right side, with a slide Lock switch on the left.

The Nomad II comes with an in-line mini control unit wired into the headphone lead, which is fine if you wearing something to clip it on. If not, it just gets in the way.





Data:

The player has a USB interface with a standard-sized socket, so you can use whatever USB cable you have at the time. While the file transfer is fast at 132KB/s, it isn't the speediest we've seen in an MP3 player.

Radio:

The built-in FM radio is quite sensitive, and its presets allow up to 32 stations to be stored. It will also auto-scan to the next station on the band, or you can tune it one step at a time with the FF button. There's also a Sleep function that can turn the radio off automatically after a preset time, but how you could sleep with those headphones on is beyond us...

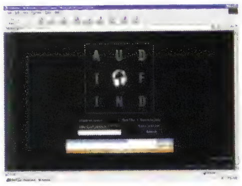
Memory:

The Nomad II has no base memory, and so relies on its single Flash Memory card for storage. The player came with a 64MB Flash card (the largest size available these days), so you won't be able to expand its memory until a larger capacity Flash card comes along.

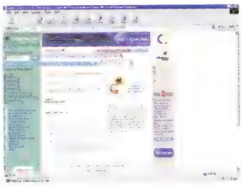
Power:

Single AA battery, 8 — 10 hours playback time quoted.
Off: 716uA (rather high)
Play: 280mA (A little on the high side)

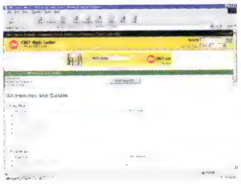
WHERE TO GO...



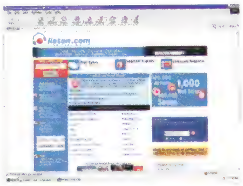
The no-nonsense Audiofind site has been around for years, and has a very simple, easy-to-use interface - go to **www.audiofind.com**.



It's not all pop and rock music, you know. Check out **www.eclasssical.com** for more Mozart than you can poke a mouse pointer at.

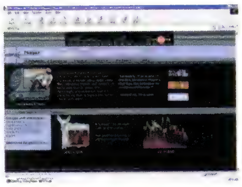


CNET has a great range of digital music tutorials. Head to the 'Play Music' section at **http://music.cnet.com.**



www.listen.com deserves a spot in your favourites list.

www.scour.com - the ultimate MP3 search tool on the net?



www.ultraplayer.com cracked the top audio site at CNET.

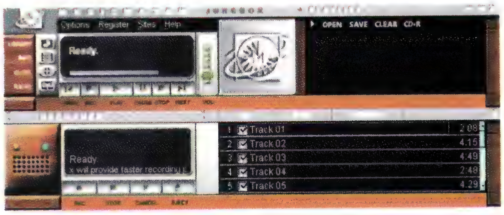
HOW IT WORKS

Ripping — with MusicMatch Jukebox

You'll find MusicMatch Jukebox all over the place, either supplied with a player, or you can download it from www.musicmatch.com for free.

Once it's installed, you'll be able to convert tracks off your CDs into MP3s, or even Windows Media Format (WMF) if that's more convenient...

1 WHEN FIRST RUN, you'll get the two panels shown here, along with a radio which we've turned off here because it gets in the way. Drop your CD into the drive, and after quick calibration, it will ask you if you want to connect to the CDDB CD Database on the Net. We're keeping this simple, so we'll say no, whereupon the recorder comes up with a list of tracks as shown.

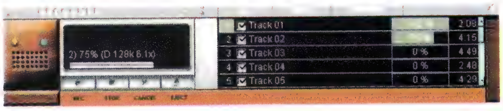


Ready.

Ready
x will provide faster recording

1 ☑ Track 01 2:08
2 ☑ Track 02 4:15
3 ☑ Track 03 4:49
4 ☑ Track 04 2:48
5 ☑ Track 05 4:29

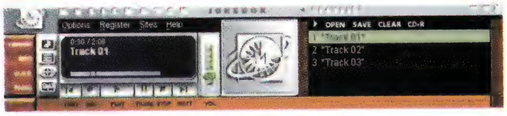
2 SELECT THE TRACKS you want to convert, (in our case, all of them), and hit the Record button. A little bar graph shows you the progress through each of the tracks, as one by one they are converted to MP3s. The default settings give you MP3s at 128kbps, but if you want another format, or bit rate, head off to the Options | Recorder | Settings menu.



2) 75% (D 128k 6.1x)

☑ Track 01 2:08
2 ☑ Track 02 4:15
3 ☑ Track 03 0 % 4:49
4 ☑ Track 04 0 % 2:48
5 ☑ Track 05 0 % 4:29

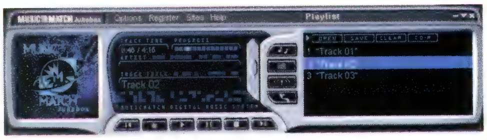
3 ONCE CONVERTED, the tracks can be loaded in and played, with MusicMatch's own built-in player. Of course you can play them just about anywhere else too, including other MP3 apps on your PC, or upload them into your personal MP3 player.



0:30 / 2:08
Track 01

2 "Track 02"
3 "Track 03"

4 And for those of you who aren't that keen on MusicMatch's wood grain panelling, there are some other skins that you can apply, including the trendy 'Digital Age' shown here.



1:46 / 4:15
Track 02

1 "Track 01"
3 "Track 03"

TIPS

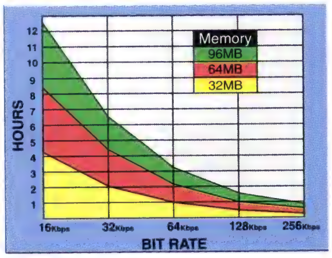
Sound Settings

● For in-ear bolas-style earphones, you are really going to need some help with the bottom end of things, so Extra Bass is the go.
For more conventional (though less popular) over-the-head headphones, you can try the various settings like 'Classic', or 'Jazz', to see what sounds best, but if you are feeding the player's output through conventional speakers, you should really use the player's 'Flat' setting.

Big files

● Two things affect the size of an MP3 music file – the length of the song, and bit-rate at which it was recorded.

You'll find 90% of MP3 songs recorded at 128Kbps, which translates to around 1MB/minute, which gives a good playback quality and a reasonable file size. If you increase the bit-rate you increase the sound quality, but as you can see in the graph below, when you double the bit-rate, you double the file size, which of course halves the number of songs you can fit in your player. Shame about that...



Variable bit rate encoding

● Instead of setting a fixed bit-rate for encoding your music, some MP3 encoders let you use VBR, or Variable Bit-Rate encoding to rip your song from CD.

VBR dynamically adjusts the bit-rate used in the encoding process, with a higher rate used for complex parts of the music, and lower rates for the less critical parts.

While VBR does produce smaller MP3 files, it can sometimes confuse some MP3 players. If you see a player's bit-rate display jumping around during playback, then your track is almost certainly encoded with VBR.

Ripping good stuff

● Converting an audio track from CD into an MP3 is known 'ripping'. So you would rip tracks 1 to 5 of your favourite album to play in your MP3 player on your way to work. The word has nothing to do with ripping off recording industry, we're sure...

FreNETic. And the first SAST model to reach our shores is the AEP-803, which unless I'm mistaken is likely to create quite a stir — not just among consumers but also among competing DVD marketers. That's because as well as sneaking in under the magic $500 barrier, it offers a bonus feature found until now only on players priced above $1000: a built-in 5.1 channel Dolby Digital decoder.

The advantage of a built-in decoder is that you can enjoy the full impact of multichannel surround sound on the latest DVDs, without having to invest in a matching digital amplifier or receiver. Since the player produces the six channels of decoded analog audio directly, you can feed these through any suitable existing amplifiers, and potentially save quite a bundle.

So having a built-in decoder is really quite an advantage, especially in a player selling for less than $500.

What other features does the AEP-803 offer? Well, not surprisingly it can play standard audio CDs as well, plus video CDs and 'super' VCDs. That's not all, though; it can also play audio CDs recorded on CD-R blanks, thanks to the use of a dual-wavelength laser pickup (650nm and 780nm). As a special bonus it can even play both CD and CD-R discs carrying the highly compressed 'MP3' (MPEG1/Layer 3) files, which allow many hours of music to be stored on a single platter.

All of which is again quite impressive, especially in a sub-$500 player. There are quite a few players selling for over $1000 which won't play CD-R discs, let alone those with MP3 files...

Other features of the AEP-803 which you might find of interest are a karaoke function, with dual microphone inputs; both optical (TOSlink) and coaxial (S/P-DIF) digital bitstream outputs, so you can use an external sound decoder if you prefer; and both S-video and composite video outputs. It's also compatible with both PAL and NTSC video, and you get two levels of digital image magnification or 'zoom'.

Oh yes — and there's also the ability to be set easily for playback of movie DVDs intended for virtually any region. A feature that's very popular with consumers, if not with the software producers...

Mind you this is, after all, an economy player. So what features *don't* you get, that are present on higher-priced players, and might be missed? Not much, at least of any great importance. For example you don't get component video outputs; but bearing in mind that only some of the latest model TV sets and projectors have component video inputs anyway, that's not likely to be much of a drawback for most buyers.

Similarly the inbuilt decoder will only handle Dolby Digital tracks as well as linear PCM sound; you'll have to use an external decoder for MPEG2 or DTS tracks. But considering the fact that about 97% of the DVDs released to date have DD tracks anyway, this again isn't likely to be much of a problem.

On the whole, then, the AEP-803 is pretty well pitched in terms of the features it provides, and especially for such a good price.

It's housed in a reasonably sturdy and cleanly styled case of fairly standard size (428 x 340 x 85mm and 5kg), finished in light grey with a moulded plastic fascia in metallic silver, and comes with a well-styled slimline IR remote providing all the necessary control functions.

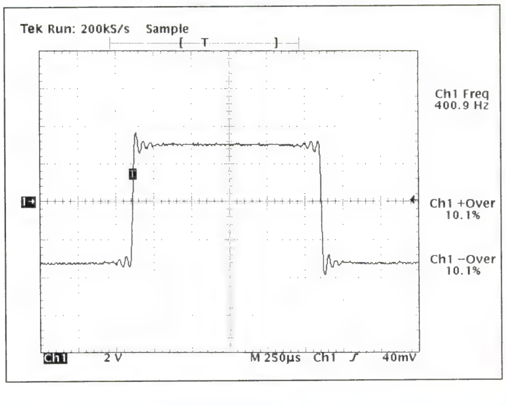
What we found

FreNETic sent us a review sample of the AEP-803, which we were able to put through its paces. Before doing so we looked inside the case though, to check build quality. This appears to be quite reasonable too, although the signal output, switch-mode power supply and karaoke mic input boards are only of SRBP ('phenolic').

The disc transport itself seems to be of Korean manufacture, while the digital serial processing and decoder board uses a C-Cube 'Ziva-3' decoder chip and an Atmel controller.

Next we tried running some basic audio tests, to get an indication of the transport, decoder and output filtering performance.

The overall frequency response from our reference CDs was quite smooth, showing ruler flatness between 40Hz and 8kHz, and drooping by only 0.15dB at 20Hz. At the high end it rose slightly to a peak of about 0.45dB at 10kHz, and then fell slowly and smoothly to be flat again at 17kHz and 1.3dB down at 20kHz. The channel balance was



***The square** wave response has only about 10% overshoot and well-damped symmetrical ringing, showing good phase response in the anti-alias filtering. This stacks up well against most players in the sub-$1000 market.*

also within 0.1dB, which is again fine.

The 'fade to noise' tests showed linear replay down to the -75dB level, with a signal to noise ratio of just on 90dB. These figures aren't quite as good as those from some of the up-market models, but they're very acceptable nonetheless.

The distortion figures were quite creditable, too. The THD from 40Hz to 3.1kHz was below 0.016%, rising only slowly at higher frequencies to reach 0.047% at 16kHz and 0.66% at 20kHz. This is better than average, especially as the residuals above 16kHz had a very low level of alias components.

The square wave and impulse responses were also very respectable, showing overshoot levels of about 10% and well-damped symmetrical ringing. This compares very well with most players in the below-$1000 market, and suggests good phase linearity in the anti-alias filtering.

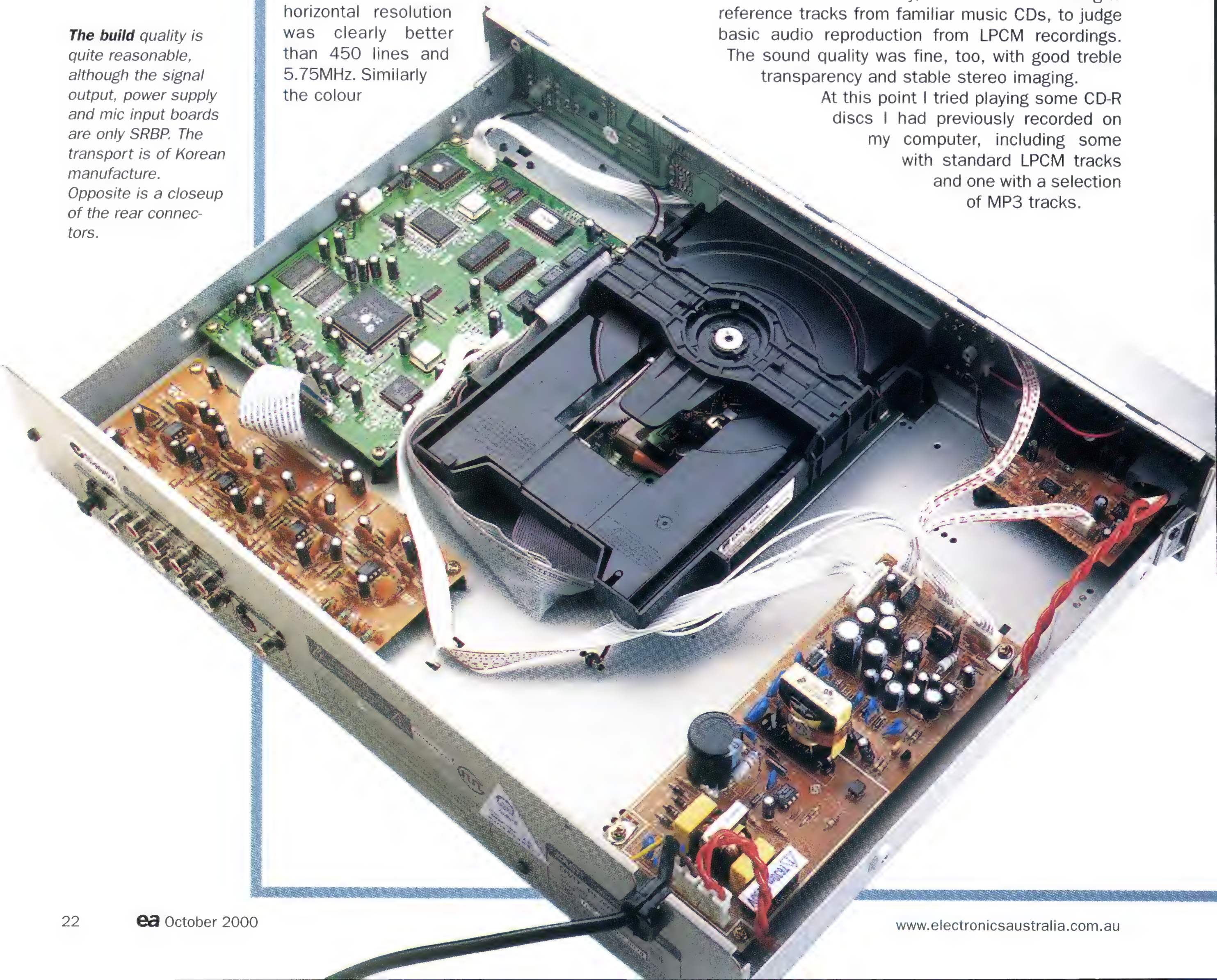
Next I tried checking the video performance, using the Video Essentials DVDI 0711 test disc. With the S-video output fed to a Sony VPL-CS1 projector, the horizontal resolution was clearly better than 450 lines and 5.75MHz. Similarly the colour resolution was quite good, with clean and sharp edges on the colour bars, and there was only the merest trace of Moire artifacts on the Snell & Wilcox 'moving Fresnel zone plate' pattern — showing very low Y/C crosstalk.

So overall, there's nothing whatever to complain about in terms of the AEP-803's image reproduction performance; it's fine.

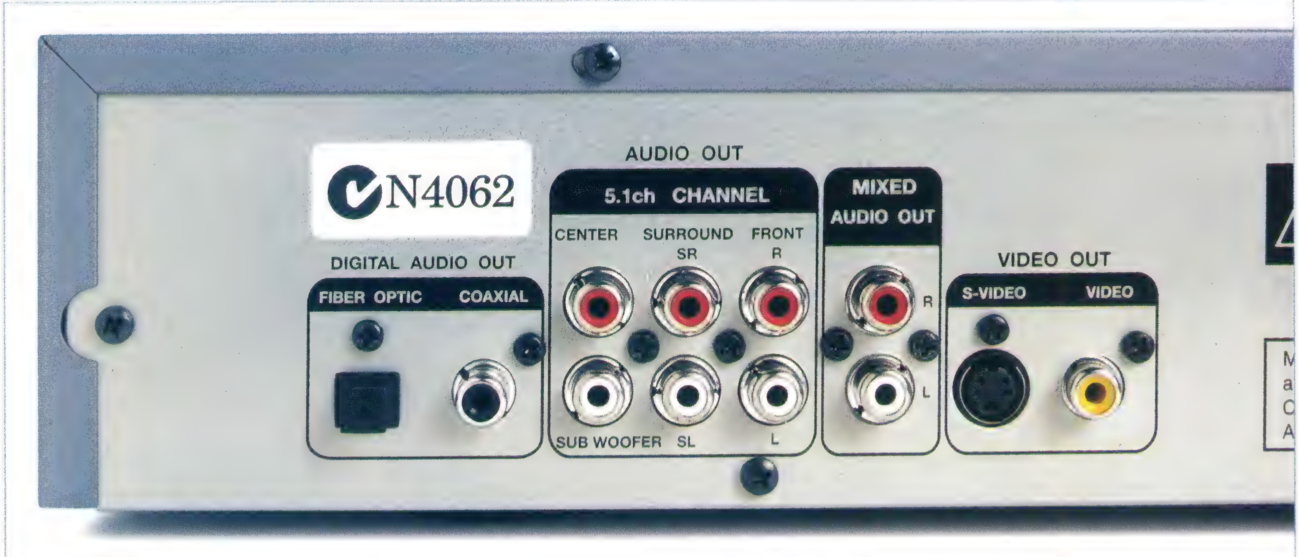
With the basic measurements out of the way, I decided to progress to the listening and viewing tests. To begin these I hooked up the player's Dolby Digital decoder outputs to the 5.1-channel inputs of the Pioneer VSX-D508 surround receiver driving my home theatre speakers, and performed the AEP-803's audio setup procedure. This involves the usual on-screen menu sequence, allowing you to indicate the size of the speakers being used for the various channels, their distances from the main viewer position and so on. Once this is done you can send a pink noise test signal to each channel in turn, to both check its operation and facilitate level balancing.

This all went smoothly, so next I tried listening to reference tracks from familiar music CDs, to judge basic audio reproduction from LPCM recordings. The sound quality was fine, too, with good treble transparency and stable stereo imaging.

At this point I tried playing some CD-R discs I had previously recorded on my computer, including some with standard LPCM tracks and one with a selection of MP3 tracks.



***The build** quality is quite reasonable, although the signal output, power supply and mic input boards are only SRBP. The transport is of Korean manufacture. Opposite is a closeup of the rear connectors.*



The AEP-803 played them all without a murmur, and very cleanly. It did become slightly confused with the track numbers on the MP3 disc, but I've found this before with other DVD players able to play MP3 tracks; they don't seem entirely happy with the table of contents on what are essentially 'data' CD-Rs.

Moving on, I then tried playing some familiar chapters and scenes from some of my reference movie DVDs — including those with good 5.1-channel 'demo' surround sound steering, like chapter 2 of *Armageddon* (with asteroids lobbing down on New York) and chapter 12 of *Dragonheart* (where Draco is flying around both the viewer and the knight). But it was here that I had my first real surprise: there was essentially no output from the surround channels!

Hmmm, what could be wrong, especially as these channels seemed fine during the setup procedure? (I even tried this again to make sure, and they were still OK...)

I tried disabling the bitstream outputs, just in case they took precedence over the inbuilt decoding; no effect. Then I studied the AEP-803's manual again, looking for clues. To be honest the manual is not very clearly written, and you really have to slog through it to work out some of the finer aspects of player operation and setup.

I thought I had found the answer when I discovered a cryptic note to the effect that for correct 5.1-channel operation, the speaker sizes all had to be set to 'small'(!). But when I did so, the surround channels *still* didn't seem to work on movie tracks.

Finally, though, I did find the answer. Another cryptic note explained that for 'valid' 5.1-channel sound output from DVD movie tracks, the player's audio mode had to be set not to 'Cinema' mode but to 'Karaoke' mode (the opposite of what you'd expect) — and then the remote control's Karaoke button pressed a number of times to take it into 'Multi Channel' mode.

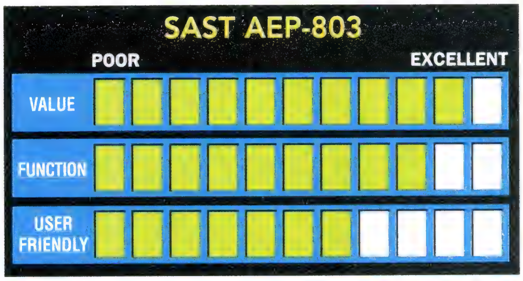
Performing this little exercise in counterintuitive logic worked, and the surround channels at last sprang into life as they should. In fact the surround sound steering was fine — phew!

So once it *is* set up correctly, the performance of the AEP-803's internal Dolby Digital decoder is fine. But the combination of a none-too-clear manual and a somewhat oddball system of mode configuration does make setup rather more frustrating than it should be.

Once this problem was sorted out, I tried watching a couple of Region 4 movie discs and also a recently arrived Region 1 disc. In each case the results were very satisfying indeed, with more than adequate picture and sound quality. (Incidentally the multi-region capability is enabled via a special menu, easily called up using a 'secret code' keyed in via the remote control.)

Summarising, then, the oddball surround sound setup is really my only criticism of the SAST AEP-803 DVD player. Overall it's capable of delivering very acceptable performance in terms of both image and sound, and must therefore be judged as outstanding value for money. Especially when you consider its under-$500 price, built-in Dolby Digital decoder and the ability to play CD-Rs and MP3 discs.

Just remember to be patient when you're setting up its surround sound mode! **ea**



SUMMARY

- An 'economy' DVD player offering excellent value for money.

PROS

- Built-in Dolby Digital decoder
- Able to play CD-Rs and MP3 discs
- Optical and coaxial bitstream outputs
- Multi-region capability

CONS

- No component video outputs
- No DTS or MPEG2 sound decoding
- Sound setup a bit weird
- Manual rather hard to follow

RRP

- $499

AVAILABLE

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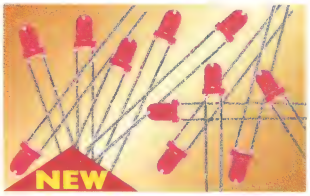

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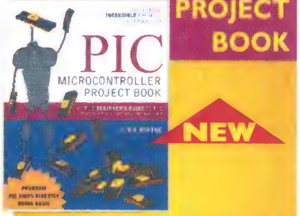

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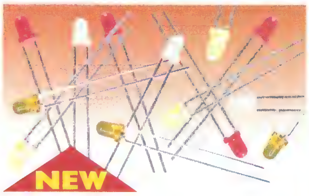

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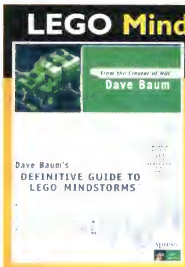

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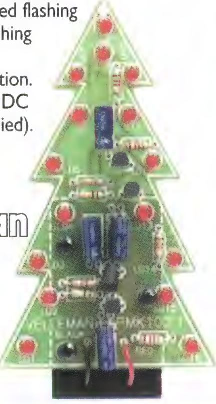

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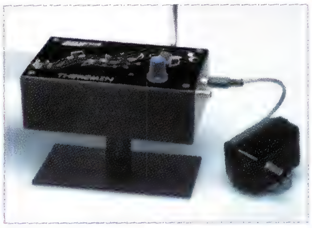

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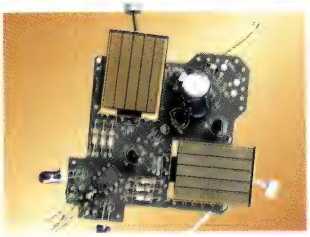

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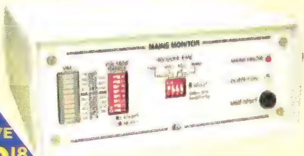

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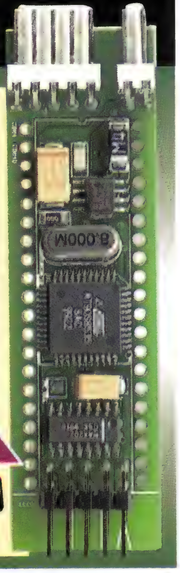

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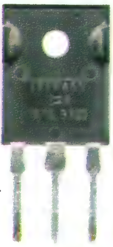

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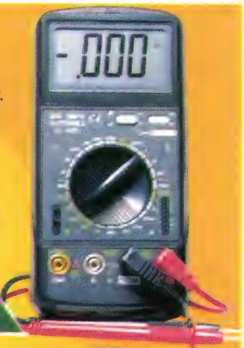

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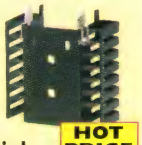

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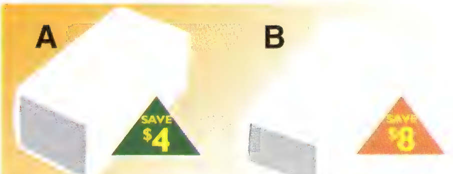

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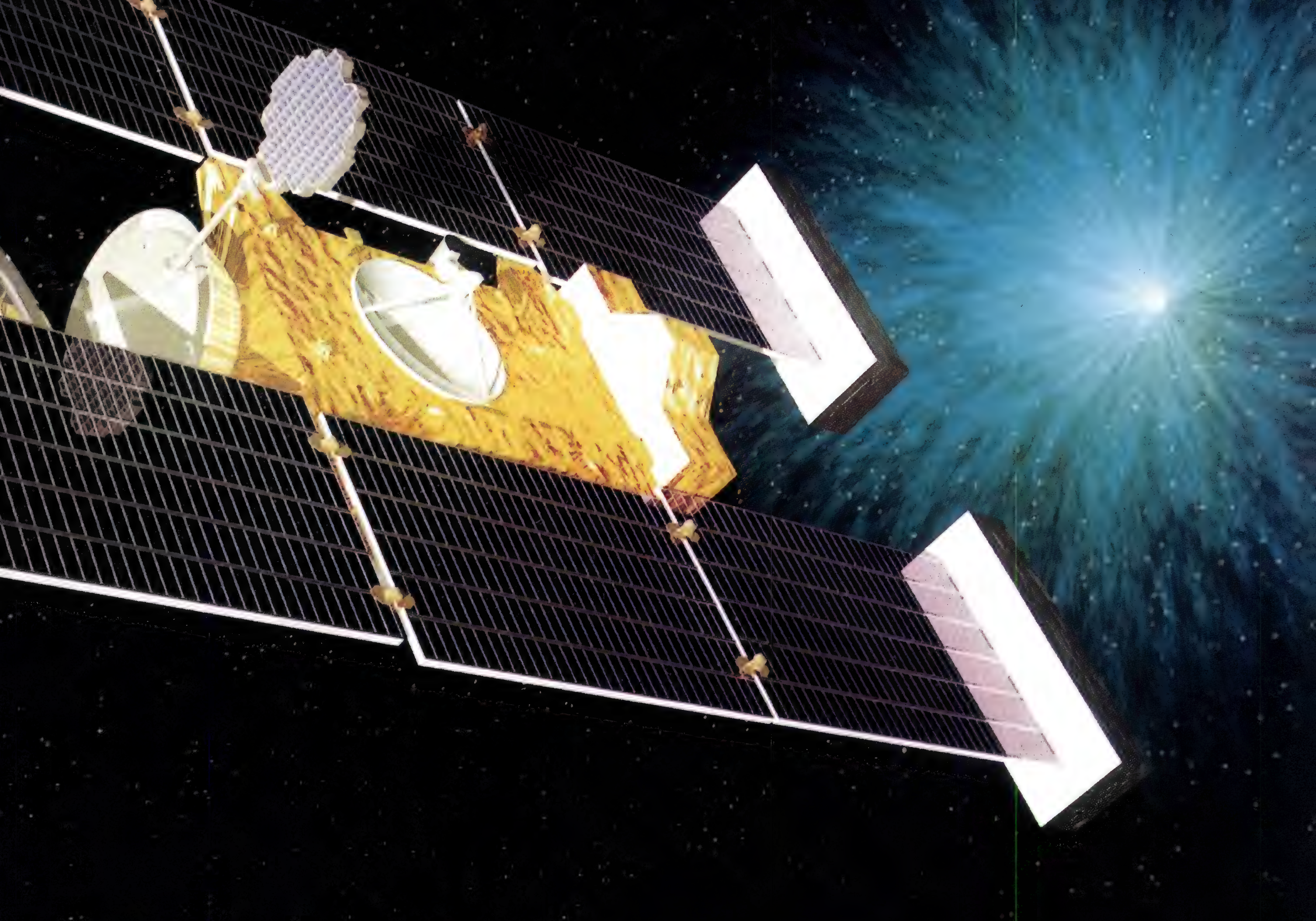
To catch a comet

One of the more enigmatic phenomena that inhabit our solar system are comets. These conglomerations of dust, ice and rock reside in the Oort Cloud on the fringes of the solar system and they regularly visit us on their speedy trip around the Sun. One such comet will undergo more scrutiny than ever before, explains **Kate Doolan**, as NASA plans to bring some of this comet home to Earth.



THOUGH beautiful to observe, comets have traditionally been harbingers of doom and have terrified people as they travel in from deep space, around the Sun and back again. Throughout history, astrologers have interpreted the sudden appearances of comets as ill omens predicting floods, famines, wars or the death of monarchs or dictators.

The most famous of all comets is Comet Halley, a comet that visits the solar system every 76 years — the last appearance being in 1985/6. Another comet (more well known for its demise than its existence) was Comet Shoemaker-Levy 9, which impacted with Jupiter in July 1994.

In February 1999, the National Aeronautics and Space Administration (NASA) developed and launched a spacecraft christened Stardust, which will encounter Comet Wild-2 (pronounced '*Vilt*') in January 2004 to collect samples of ice and dust. Two years after the encounter, a portion of the spacecraft will parachute back to Earth with the samples.

Three payloads

The Stardust spacecraft is derived from a deep-space bus known as Spaceprobe which was developed by Lockheed Martin Astronautics. Stardust is carrying three scientific payloads — a two-sided dust collector, a comet and interstellar dust analyser, and a dust flux monitor. Scientific data is also collected through other spacecraft components including its 'recycled' navigation camera (see Second-hand Spacecraft).

The spacecraft only needs a modest propulsion system, as it is on a low energy trajectory to its destination. A gravity assist manoeuvre in January 2001 with the spacecraft flying by Earth will also provide assistance.

During distant imaging of Wild-2's coma (the envelope of dust and gas that surrounds the centre of a comet), the camera will take images through a periscope in order to protect the camera's main optics from the blast of incoming particles. In the periscope, light is reflected off mirrors manufactured of

highly polished metals designed to minimise image degradation whilst withstanding high-speed particle impacts.

Two solar panels affixed to the spacecraft were deployed thirty minutes after launch. Together they provide 6.6 square metres of solar collecting area using high efficiency silicon solar cells. One 16A/H nickel hydrogen battery provides power when the solar arrays are pointed away from the Sun, and during peak power operations.

The spacecraft is equipped with a transponder originally designed for the Cassini mission, as well as a 15 watt radio frequency solid state amplifier. Communications are primarily conducted through Stardust's medium-gain antenna. Three low-gain antennas are used for initial communications near Earth and to receive commands when the spacecraft is in any orientation. Data rates will range from 40 to 4,000 bits per second. During the Wild-2 encounter, Stardust will use a 600mm high-gain antenna to transmit images of the comet's nucleus as well as data from the dust flux monitor and interstellar dust analyser. This high gain system will minimise the transmission time, and thus the risk of losing data sent through the medium-gain antenna.

Most data from the spacecraft will be received through NASA's Deep Space Network which has stations located at Goldstone, California; Madrid, Spain and Tidbinbilla in the Australian Capital Territory. The DSN's 34 metre antennas will be used and the 70 metre antenna will be used during some critical telecommunication phases such as when Stardust transmits data before, during and after the Wild-2 encounter.

Onboard analysis

Stardust's Comet and Dust Analyser is derived from the design of an instrument that flew on the Giotto and Vega spacecraft that encountered Comet Halley in 1986. The instrument was able to obtain unique data on the chemical composition of individual particles in Halley's coma. The Stardust version will study the chemical composition of particulates in Wild-2.

Aerogel — It's nearly not there...

As you can imagine, catching a piece of comet is rather difficult to do — particularly when you realise that the particles being collected are travelling at around nine times the speed of a rifle bullet. Although the captured particles are smaller than a grain of sand, high-speed capture could alter their shape and chemical composition — or vaporize them entirely.

So how do you do it? With an extraordinary substance called Aerogel.

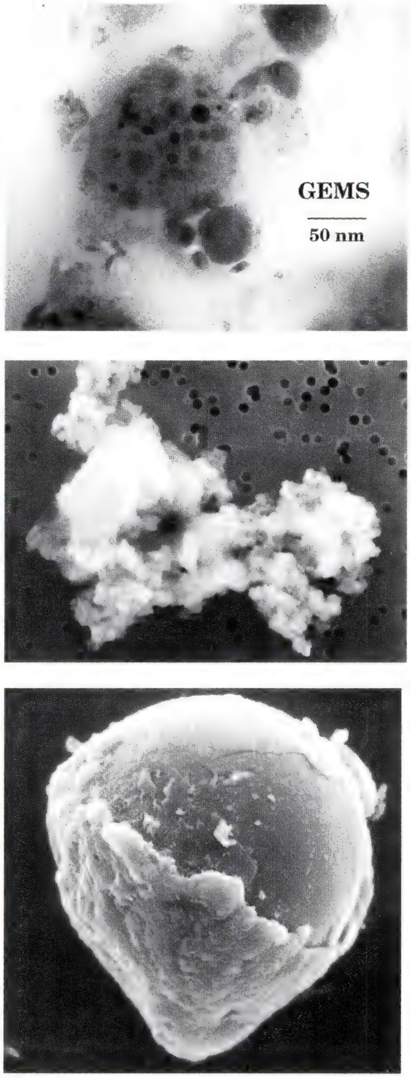
Aerogel is a silicon-based solid with a porous, sponge-like structure in which 99 percent of the volume is empty space. Aerogel is 1000 times less dense than glass, another, more common silicon-based solid. When a particle hits the Aerogel, it will bury itself in the material, and slowly decelerate leaving a trail behind it. Since Aerogel is just about transparent — It looks not unlike a block of solid smoke — you can use these tracks to find the tiny particles.

This exotic material has many unusual properties, such as uniquely low thermal conductivity, refractive index, and sound speed — in addition to its exceptional ability to capture hypervelocity dust. Aerogel is made by high temperature and pressure critical drying of a gel composed of colloidal silica structural units filled with solvents. Over the past few years, Aerogel has been made by the Jet Propulsion Laboratory.

The purpose of the analyser is to intercept and perform instantaneous compositional analysis of dust as it is encountered by the spacecraft. Data is then transmitted to Earth as soon as a communication link is available.

The instrument is a mass spectrometer which separates the masses of ions by comparing differences in their flight times. When a dust particle hits the instrument's target, the impact creates ions that are extracted from the particle by a electrostatic grid. From this information, the ion's chemical identification can be made.

The other main instrument in Stardust is the Dust Flux Monitor, which measures the size and frequency of dust particles in the comet's coma. The instrument consists of two film sensors and two vibration sensors. The film sensor consists of a material that registers impacts by generating a small electrical signal when penetrated by dust particles. The mass of the particle is determined by measuring the size of the electrical signals, while the number of particles is determined simply by counting the number of pulses. By using two film sensors with different diameters and thicknesses, the instrument will provide data on particle sizes and the distribution of the particles encountered.



GEMS *(glass with embedded metal and sulfides) are a major component of interplanetary dust. The glass sphere above has a cone shaped cap of compressed aerogel that built up on the leading edge of the sphere and served as a insulating shield that partially protected the particle.*

Stardust itself is protected from the blast of cometary particles by two bumpers at the front of the spacecraft which protect the solar panels, with another shield protecting the main body of the spacecraft. Each of the shields were built around composite panels designed to disperse particles as they impact, augmented by blankets of Nextel ceramic cloth that further dissipates and spreads particle debris. The shields are named after Dr Fred Whipple in honour of his groundbreaking work in cometary science.

Catching comets with Aerogel

A cube of Aerogel looks like solid pale blue smoke. It is the lightest and lowest mass solid known and was thought to be ideal for capturing small particles in space.

The size of the particles collected in the Aerogel is expected to range from a micron (a millionth of a metre) to 100 microns (1/10th of a millimetre). Stardust scientists anticipate that the Aerogel will return a few particles at the upper end of this size range and a million particles in the sub micron range.

One side of the dust collection module known as the 'A' side will be used for the comet encounter whilst the 'B' side will be used for collecting interstellar dust. More than 1000 square centimetres of collection area is provided on each side.

Stardust's cometary and interstellar dust collectors each have 130 rectangular blocks of Aerogel measuring 2 x 4 centimetres, plus two smaller rhomboidal blocks. The thickness of the Aerogel on the cometary particle collection side is three centimetres whilst the thickness of the Aerogel on the interstellar dust particle collection side is one centimetre. The density of the Aerogel is graded-less dense at the point of particle entry and progressively denser deeper in the material. Each block of Aerogel is held in a frame with thin aluminium sheeting.

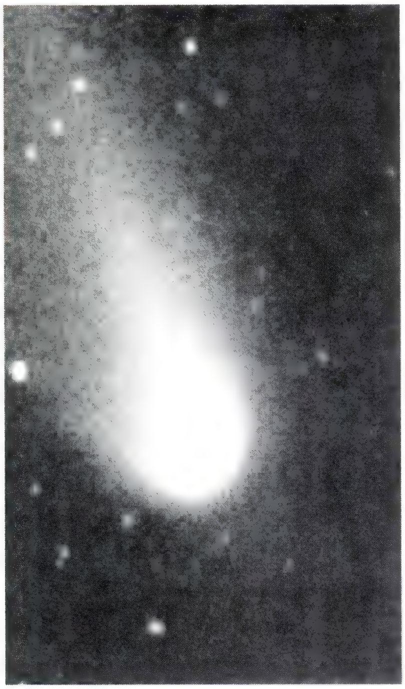
Jelly and chips

t's not just rocket scientists that are nterested in Aerogel; chip designers are also looking to this strange substance for increased speed and educed power consumption in their nicroprocessors.

Good insulators let chip designers olace interconnects close together vithout affecting the electrical signals. Air, the perfect insulator, has a dielectric constant of 1.0. But you can't hold chips together with air. Silicon dioxide, the material now used on most chips, rates at about 4.

Researchers at Rensselaer Polytechnic Institute in Troy, New York, are creating a chip insulator with Aerogel which could more than double current computing speeds. While not as good as air, Aerogel's dielectric constant dips as low as 2.5, which is a whole lot better than the usual Silicon dioxide. Rensselaer researchers expect the industry to start using Aerogel within five years.

Meanwhile, Texas Instruments recently demonstrated a similar substance called Xerogel, which is made of microscopic glass bubbles containing air. The company estimates that within a decade, combining Xerogel with copper wires could result in chips that are 10 times faster than today's fastest chips, and would be used in cellular phones, notebook computers, and even video watches. A single chip the size of a fingernail, TI claims, will pack over 500 million transistors.



Periodic comet *Wild 2 is new to the inner solar system. By the time Stardust encounters the comet, Wild 2 will have made only five trips around the sun. By contrast, Comet Halley has passed the sun more than 100 times.*

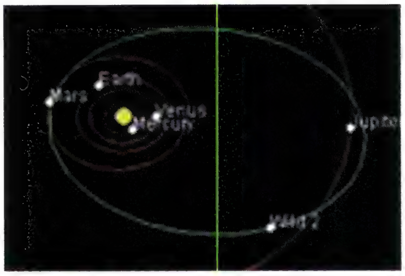
Return to Earth

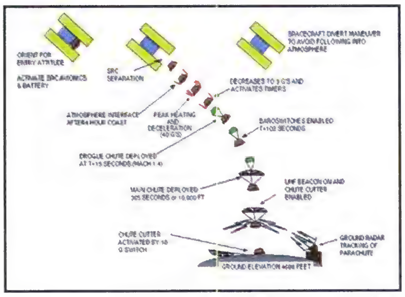
To collect the particles without damaging them, Stardust will use the fascinating substance Aerogel which is a silicon based solid with a porous sponge like structure in which 99 percent of the volume is empty space. Aerogel is made from fine silica mixed with solvent. The mixture is set into moulds of the desired shape and thickness then pressure cooked at high temperatures.

Overall the collection unit resembles a cross between a metal ice tray and an oversize tennis racquet. The sample return capsule is little less than a metre in diameter and opens like a clamshell to extend the dust collector into the dust stream. After collecting samples, the cell assembly will fold down for stowage into the sample return capsule.

The sample return capsule is a blunt nose cone with a diameter of 81 centimetres. It has five major components: a heat shield, sample canister, back shell, parachute system and avionics. The total mass of the capsule including the parachute system is just over 45kg.

A hinged clamshell mechanism opens and closes the capsule. The dust collector fits inside, extending on hinges to collect samples and retracting the fold back down inside the capsule, The capsule is encased in ablative materials to protect the samples stowed in its interior from the heat of reentry.





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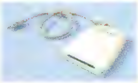
The heat shield is constructed from a graphite epoxy composite covered with a thermal protection system made from a phenolic-impregnated carbon ablator, developed for use on high speed reentry vehicles. The capsule's heat shield will remain attached to the capsule throughout descent and serves as a protective cover for the sample canister at touchdown.

The back-shell structure is also constructed from a graphite-epoxy composite covered with a thermal protection system that is made of a cork based material called SLA 561V. This material was developed by Lockheed for use on the Viking missions to Mars in 1975/6 and is currently used on the Space Shuttle's external tank. The back shell provides the attach points for the parachute system.

The parachute system incorporates the main parachute and a drogue inside a single canister. As the capsule descends towards Earth, a gravity switch sensor and timer will detonate a pyrotechnic gas cartridge that will pressure a mortar tube and expel the drogue chute. The drogue chute will be deployed an altitude of 30 kilometres at a speed of mach 1.4 to provide stability to the capsule. Based on information from the timer and backup pressure transducers, a small pyrotechnic device will cut the drogue chute from the capsule at an altitude of three kilometres from the Earth's surface. As the drogue chute is jettisoned, it will extract the 8.2 metre parachute from the canister. Upon landing, cut-

MicroGram Computers



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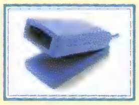

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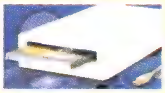

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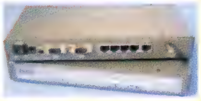

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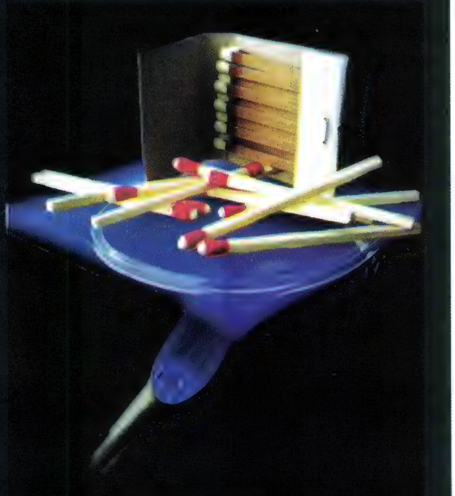
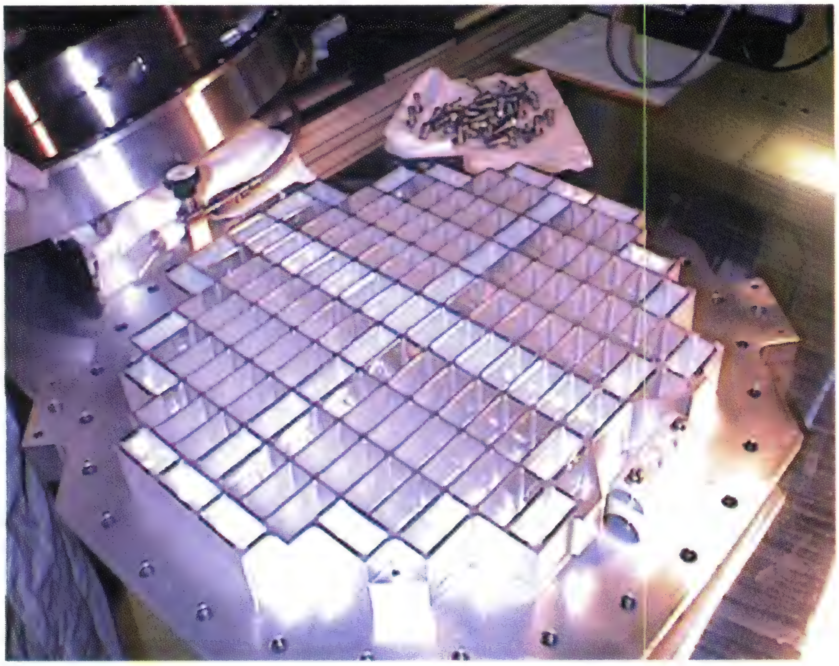
- **Aerogel is 99.8% air**
- **It is 39 times more effective than the best fiberglass insulation**
- **It's also 1000 times less dense than glass**
- **Aerogel is only 3 times denser than air.**
- **It has a refractive index of 1 — 1.05.**
- **It was used to insulate Sojourner during the Mars Pathfinder mission.**
- **The first silica Aerogels were manufactured in space in April 1996 on a Conquest rocket.**





***Cells filled** with Aerogel are mounted on both sides of a two-sided, grid-shaped array that will deploy from the Sample Return Capsule. After exposure, the cells assembly will fold up to a compact configuration for stowage into the Earth return capsule.*

ters will fire to cut the main chute cables so that winds do not drag the capsule along the ground.

Where is it?

The capsule carries an ultra-high frequency radio locator beacon to be used in conjunction with locator equipment on the recovery helicopters. The beacon will be turned on at main parachute deployment and will remain on until turned off by the recovery teams.

The beacon is powered by redundant sets of lithium sulphur-dioxide batteries which have a long shelf life and can tolerate wide temperature extremes as well as being safe to handle. The capsule carries enough battery capacity to operate the UHF beacon for at least forty hours.

The landing site is at the Utah Test and Training Range near Salt Lake City and was chosen because the area is a flat, desolate and unoccupied salt flat controlled by the United States Air Force. The landing area for the capsule will be about 30 x 84 kilometres which is an ample space to allow for aerodynamic uncertainties and winds that may affect the direction that the capsule travels whilst in the atmosphere. To land within the area, the capsule's trajectory must achieve an entry accuracy of 0.08 degrees, which it should do in the early morning of 15 January 2006.

Following landing, the capsule will be transported to a staging area at the Utah Test Facility where the sample canister will be removed. The sample canister will then be flown to its permanent home at the Planetary Material Curatorial Facility located at the Johnson Space Centre in Houston, Texas. There scientists will start their research and later will report their findings.

Where am I?

The attitude control system is used to manage Stardust's orientation in flight. Like many planetary spacecraft, Stardust is three-axis stabilised. Stardust determines its orientation at any time using a star camera or one of two inertial measurement units, each of which comprises of three ring laser gyroscopes and three accelerometers.

The inertial measurement units are needed only for trajectory correction manoeuvres and during the Wild-2 flyby where stars may be difficult to detect. Otherwise, the spacecraft can be operated in a mode using stellar guidance for positioning. Two sun sensors serve as backup units, if need to augment or replace the data provided by the rest of the spacecraft's attitude control system's elements.

For propulsion, Stardust has two sets of hydrazine-powered thrusters; eight larger ones that each generate 4.4 newtons of

Vital statistics

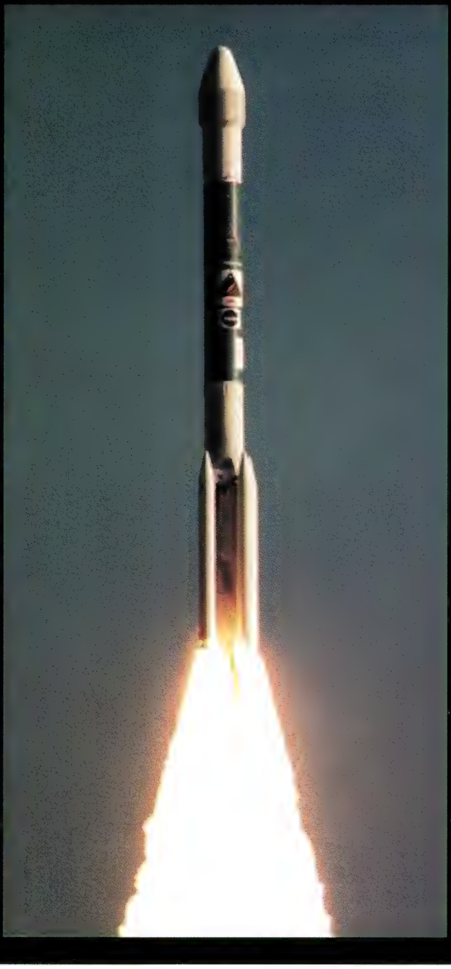
Stardust weighs in at 385kg which includes propellant and the sample return capsule. The main bus of the spacecraft is 1.7 metres high, 660cm deep and 660cm wide. The panels constructing the spacecraft have been manufactured with a core of aluminium honeycomb with outer layers of graphite fibre and polycyanate face sheets.

Second-hand spacecraft

The navigation camera used on Stardust is capable of acquiring images with a resolution of six metres per pixel at a distance of 100km. Not bad for something built from leftovers...

Stardust's camera is a combination of spare components left over from previous planetary missions, with the main camera being a spare wide angle unit left over from Voyager. The camera also uses Voyager's eight-position filter wheel, thermal housing, space optics and mechanisms, and the spacecraft designers also added a thermal radiator.

Stardust's modernised sensor head is left over from Galileo, and uses the existing Galileo design updated with a 1024 X 1024 pixel array charged coupled device taken from Cassini, which has been modified to use new miniaturised electronics.



A PowerPC — in space!

Stardust's computer is located in the spacecraft's command and data handling subsystem, and provides computing capability for each of the spacecraft's systems.

At its heart is a RAD6000 processor — a radiation hardened version of the PowerPC chip that can be switched between clock speeds of 5, 10 or 20MHz. The computer includes 128MB of RAM, because unlike other planetary spacecraft, Stardust does not have an onboard tape recorder and instead stores data in its RAM for transmission to Earth.

The spacecraft uses approximately 20 percent of the 128MB for its own housekeeping — The rest of the memory is used to store science data and for computer programs that control science observation. Memory allocated to specific instruments includes 75MB for imagery taken by the navigation camera, 13MB for data from the comet and dust analyser and 2MB for data from the dust flux monitor.

thrust used for trajectory correction manoeuvres or to turn the spacecraft, and eight smaller thrusters that produce 0.9 newton which will be used for attitude control. Stardust carries a total of 85 kilograms of hydrazine propellant.

Take off

The Stardust spacecraft was flown to the Kennedy Space Centre in Florida aboard a C-17 aircraft on 12 November 1998. After pre launch checkouts, the spacecraft was mated to the Delta II launch vehicle in late January 1999 at the Complex 17 Launch Pad A. Three days later, the fairing was placed around the spacecraft.

After delays due to small technical hitches and weather concerns, Stardust was launched on 07 February 1999. 27 minutes after launch, the spacecraft successfully made contact with the DSN station at Tidbinbilla.

Stardust's first two years of flight will take it on one orbital loop of the Sun. During March 2000 when Stardust was between the orbits of Mars and Jupiter, it was at its furthest point from the Sun. The spacecraft's engines then fired to put it on course for the gravity assist flyby of Earth in January 2001. From March through May 2000, Stardust opened its collector mechanism and began collecting interstellar particles.

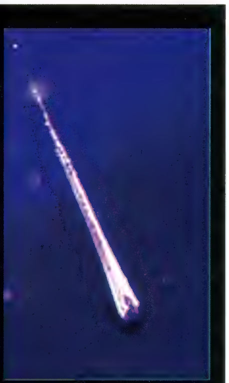
At the conclusion of the first orbit of the Sun, Stardust flies to within 5,964 kilometres of Earth on 15 January 2001. This will increase the size of Stardust's flight path to a 2 1/2 year loop of the Sun. The spacecraft will stay on this path for two more orbits.

On 25 July 2003, Stardust will fire its thrusters to fine tune its flight path through Wild-2's coma based on updated information on the position of the comet's nucleus provided by the navigation camera.

The encounter of Wild-2 will take place on 01 January 2004 and this so far largely unheralded Stardust spacecraft will hopefully give us more pieces to solve the puzzle of why we are here and how we got here.

The author wishes to thank Jan Clark of Lockheed Martin; sister Gerardine Cooney; Maggie Persinger of the Kennedy space centre; James rose, Aimee Whalen and Mary Hardin of the Jet Propulsion Laboratory for their assistance in the completion of this article. Photos courtesy of NASA and Lockheed Martin.

Are YOU in Stardust?



Another major payload aboard Stardust are two microchips containing the names of 1.13 million people including your scribe and her cat Benedick! The names were etched onto fingernail sized silicon chips. Writing on the microchips is so small that 80 letters equal the width of a human hair. The names can only be read with the aid of an electron telescope.

In addition to holding names from the public, one of the chips contains all of the names of the 58,214 American men and women who died in the Vietnam War and are memorialised on the Vietnam Memorial Wall in Washington DC.

Honey, I shrunk the server...

Something of an informal competition seems to running amongst some of the universities and labs out there to see who can create the world's smallest web server — **Richard Berry** has been checking out the rivalry.

YOU'D BE FORGIVEN for wondering why so many companies and research institutions are keen to develop smaller and smaller web servers of limited power and storage capacity. After all, you really need large and powerful server to handle the needs of the World Wide Web, right?

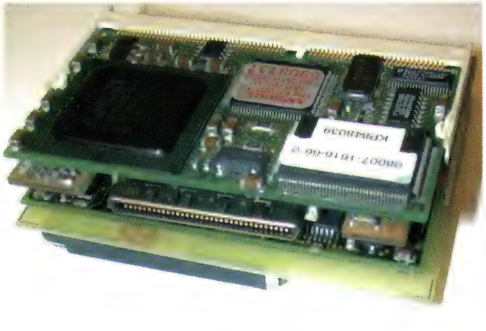
If you're a large institution, business or an ISP this is certainly the case, but if your aim is to just access a computer-based device over the web, then a very small and low-cost server is the goal. The host device might be anything from a vending machine to mission-critical backup equipment, but when it's 'web-enabled' tasks such as fault diagnosis, firmware updates and remote control become a snack — the device is now instantly accessible.

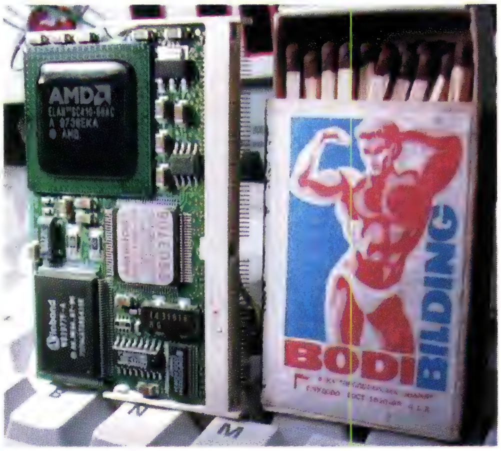
There's also an argument that suggests devices are less expensive to manufacture when web-enabled, since costly interface components such as display screens and keyboards can be eliminated. In effect, the web server-equipped device now uses the screen

Stanford

Some of you may be familiar with Stanford University's wearable labs 'matchbox' server, but let me tell you, this is a behemoth compared to some of the examples I've managed to dig up.

Stanford has taken the approach of more or less 'shrinking down' a conventional computer. A 100MHz processor underclocked to 66MHz to negate the need for a heatsink, 16MB of RAM plus 16MB of flash ROM containing enough Linux to act as an operating system has kept **http://wearables.stanford.edu/** running continuously since January 1999. However, this represents the 'sledgehammer to crack a walnut' approach when seen in light of the single chip micros being used elsewhere.



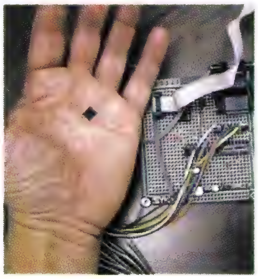


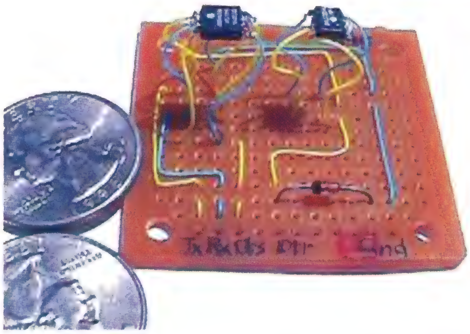
You can (literally) log into Stanford's matchbox server at telnet **wearables.stanford.edu** (login: guest), where you can access a number of Unix commands to give you a more intimate view of the server's processes. A more fully featured 4-layer matchbox PC can also be seen at the Stanford site.

iPic

What we're talking about here is a matchhead server. iPic is a tiny TCP/IP stack and HTTP webserver built on a microchip. It connects via a router to **http://www-cs.cs.umass.edu/~shri/iPic/fs/** where you may view the files it holds.

Author Shrikumar claims a variety of future uses for the miniscule server, including networking electrical items within the home and office, as well as on the road in items like mobile phones, pagers and personal organizers. The chips cost less than a dollar each, and by using a little lateral thought all sorts of possibilities come to mind (hmm, network my toaster?). Don't be fooled by its size, as iPic will service around 7200 hits per hour, which more than enough for a wide variety of applications.





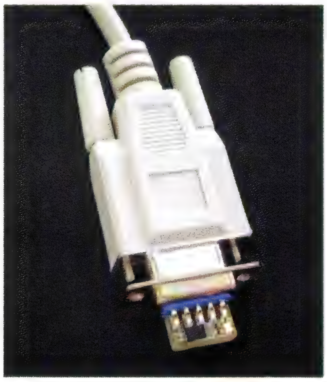
and keyboard of the remote computer (somewhere else on the network), which leads to an overall cost saving. As you'd imagine then, the smaller and less expensive the web server module, the better.

But what's a web server?

As you 'travel' around the World Wide Web using your browser to view pages from remote websites, the information is in fact delivered or served to your machine in response to a request from the browser — and it's a web server that does it. Type in 'www.electronicsaustralia.com.au/index.htm', press return, and (to put it simply) the browser sends a request for that web page to the server here at EA, as defined in the HTTP protocol standard.

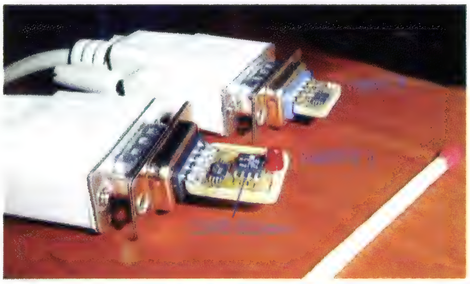
The server then sends the requested page back to your browser, which interprets and displays the page accordingly.

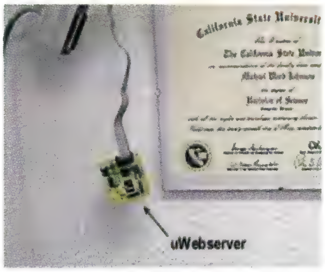
webACE



Still too large? The most authentic claim to world's smallest webserver probably comes from the webACE. The webACE is a Fairchild ACE1101MT8 microcontroller set up by one Fredric White, who claims it will handle some three hits per second with a round-trip ping time of 50ms on his LAN.

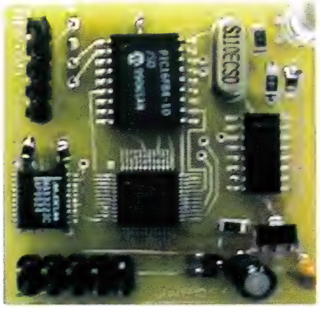
The webACE weighs in at half the size of the iPic, and is actually the smallest micro-controller built, holding as it does enough data for 2 web pages. WebACE serves up a dynamic web page which will show you its hits in real time, and let you turn its LED on and off if you wish. Obviously connectivity becomes the hard part at these dimensions, since as you can see from the attached photo, the serial cable dwarfs the tiny webACE chip.

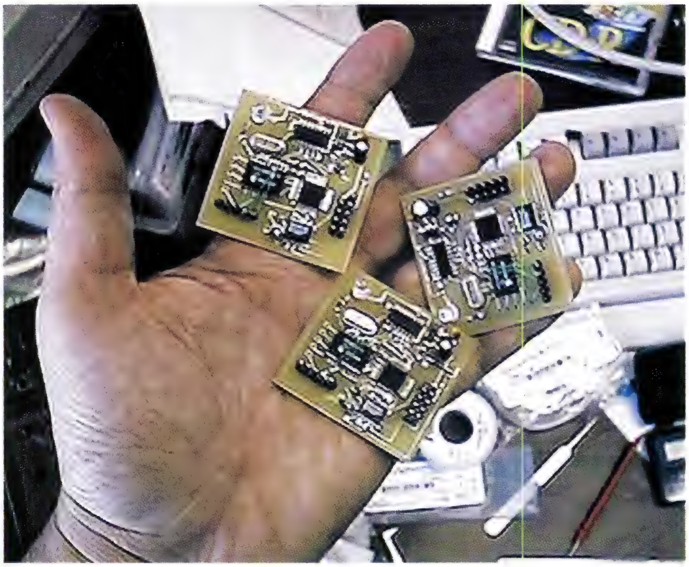




Iready

Iready technology has produced a small circuit board based model utilising a tiny Seiko chip. Though not in the running for smallest by any means, the site at **http://www.mycal.net/wsweb/** offers some excellent schematics and support for those of you who are inclined to build one of these baby servers as a project.





The server software handles all of the web page serving plus security tasks, but its most basic function is to just send you the pages you've requested. The only way it knows who you are is the 32-bit Internet Protocol (IP) address tagged onto each request — you have one of those assigned by your Service Provider (ISP) when you log on.

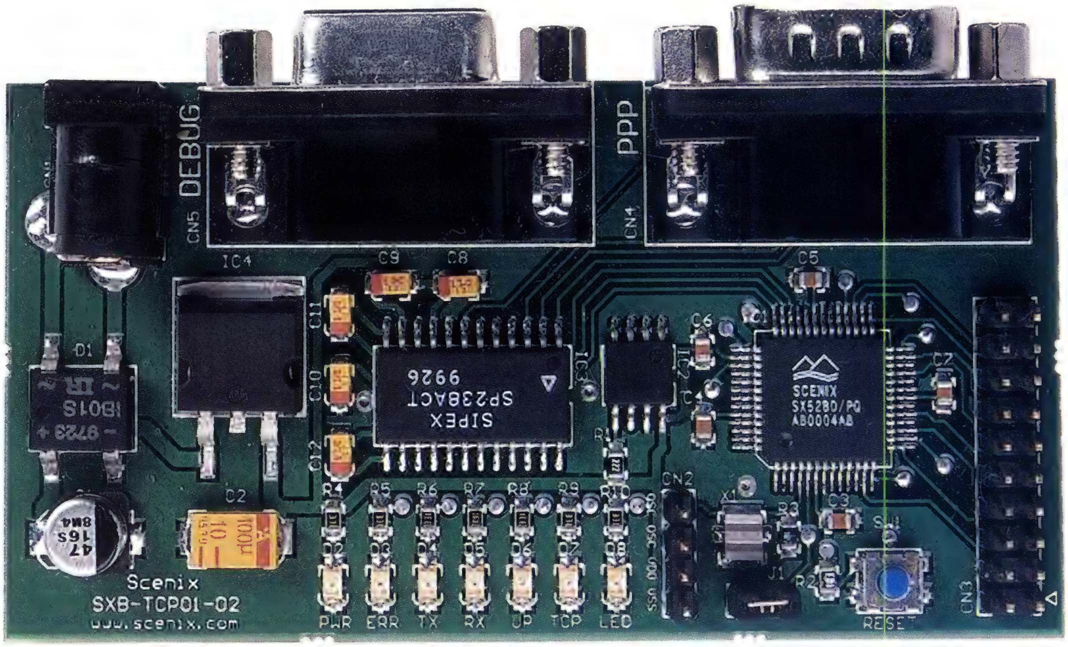
The basic task of serving web pages takes surprisingly little code (a few hundred lines of C) and can be run on quite a low-spec microprocessor, or for that matter, even a humble microcontroller.

Get your own web server!

Like to try your hand at running your own mini Webserver? Well you can, with the Scenix SX-Stack evaluation board.

The SX-Stack is a fully operational Web server, measuring only 85 x 45mm, and runs on a 50 MIPS SX52BD communications controller. It simply plugs into your computer's serial port, and will serve web pages stored in its on-board 32K EEPROM.

It comes pre-programmed as a webserver, right out of the box. It also comes with its own website

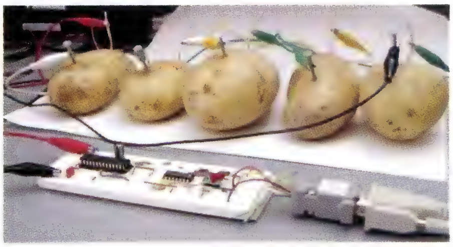


Spud power

Lastly I'll leave you with news of the worlds first vegetable powered computer, the Potato Server. Following a link to a 'potato server', Fredric White (author of the webACE project) found himself at a site pronouncing that he was the victim of a practical joke, as no such thing existed. Spurred on by this he was determined to make it so, and came up with the Spudserver shown here.

The Spudserver is a PIC16F876 microchip running with a 76.8kHz clock and a nominal 1.5V supply voltage. At these specs it draws 20 microwatts, or roughly 1 millionth the power of a typical Intel 386 board. The serial port itself is powered separately, but the CPU is potato driven — a silly yet somehow inspired feat. The server is understandably very slow (about 0.2 hits per second), nevertheless I was able to log in to view the following statistics, displayed in real time:

Voltage: 1.45V
Current: 13.0uA
Uptime: 4 days 12:40:18
Visits: 011806



ready installed, including a number of HTML pages with images, a PDF of the Scenix controller, and even a mini Java application.

We received the SX-Stack direct from Scenix in the US, and it came with a 9-pin serial cable, a CD-ROM containing support software, and a rather comprehensive user's guide. It also arrived with an American (110V) plugpack, so we had to dig up an Australian replacement to get it all going.

The guide was quite lucid, and after following the step-by-step instructions, we could configure Dialup Networking in Win95 to connect to the server just as it would to our usual ISP.

After firing up Explorer, we were in, and wandering around the mini website residing on the server's tiny little 5mm^2 surface-mount EEPROM.

It's all good fun, and with the software supplied on CD you can upload your own pages into the mini server, and even embed it into another piece of equipment to create your own Internet appliance.

The SX-Stack has a 20-pin I/O header for hooking up analogue and digital inputs, so you should have little trouble making up your own web-enabled coffee maker...

Wait, There's more!

Yes, the SX-Stack isn't just a web server — it can be re-programmed to send emails as well! There isn't enough space in the controller's Flash ROM to hold both the email and Web server software, however it is a simple matter to reprogram it as an 'email appliance', and it can then send (and receive!) email messages using the standard SMTP/POP3 email protocols. The server can monitor it's analogue and digital inputs and send emails when a certain parameters exceed a preset limit.

Sounds fun? It sure is — we certainly enjoyed playing with it, and hoped to get it up and running on our website. Unfortunately there are some security issues with our firewall that will have to be resolved before we can get it up there 'live', so until then you'll find a mirror of the SX-Stack's mini website at: **www.electronicsaustralia.com.au/scenix**

Log on and have a look around, and then if you are interested in getting one for yourself, head on over to Scenix' website (**www.scenix.com**) where they are selling the SX-Stack for just US$99 — a pretty cheap way to start running your own web server! ea

Links

http://wearables.stanford.edu/
http://www-ccs.cs.umass.edu/~shri/iPic.html
http://world.std.com/~fwhite/ace/
http://totl.net/Spud/
http://www.mycal.net/wsweb/

PocketMail for your Palm

Email on your Palm Pilot? It's been done before, but never like this... No wires, no phone sockets, and you can use it anywhere in the world. Oh, and did we say that you can link into your existing email accounts too? No? Well guess what, you can.

by Jean-Baptiste Cattley

SUMMARY

A handheld email add-on for the Palm Pilot PDA

KEY FEATURES

- Send and receive emails from anywhere in the world.
- Suits any phone, even mobiles.
- No cables!

PROS

- Simple and easy to use
- Handy mail-to-fax gateway

CONS

- A little expensive

RRP

Under $199

AVAILABLE

Dick Smith Electronics, Tandy, Office Works, Strathfield Car Radio and Telstra stores.

IT SEEMS the world runs on email these days — if you have a desk job of any kind, you doubtless have email, and I'm guessing that if you're reading this magazine, you have at least one personal email account as well.

If you have mail, you obviously need to be able to check it, and a lot of the time you want to be able to check it when you're away from your own computer. There are already web-based email mail gateways that let you check your mail, but this means you have to be at someone else's computer, instead. Or in an internet café, but if the mail's that important, maybe too much coffee is a bad idea.

Of course, if you have a Palm Pilot, you have a perfectly good little computer right in the, err, palm of your hand. You could get a Palm Modem, but then you need a dialup ISP account, and a modem cable which most certainly does not fit in the palm of your hand. (You could try to a start a new fashion by carrying the cable wound around your arm... Nah).

Also, you need somewhere to plug the accursed thing in, and rummaging around behind the sofa to find the phone socket is still considered imposing a little on most people's hospitality, let alone a hotel room or even public phone box, where you are unlikely to find a phone socket at all. This is where the PocketMail BackFlip for Palm comes in.

Brave step

Taking a closer look at the needs of email users, PocketMail have abandoned complicated, expensive remote access solutions, and instead have taken a rather brave step back in history — the PocketMail modem uses a good old-fashioned acoustic coupler.

Now, a lot of people have turned up their noses at the idea of such blatant retro-tech, but when it comes down to it, I think PocketMail should get an award for the most appropriate use of technology I've seen in years. It's cheap, it's fast enough for email, it's robust enough to handle most audio environments (modems have come a *long* way since the 70s — I had a hard time trying to break the connection without actually moving the unit away from the phone), and it's simply the most elegant solution to modem access for portable devices that I've seen.

I don't say I'd like to surf the web with an acoustic modem bleeping away at 1200 baud, but 30 seconds of canaries on PCP while downloading your mail should be easy enough to put up with for most people, I think.

Simple setup

Installing the PocketMail BackFlip is about as painless as it gets, as holds true for most Palm accessories. Installing the application took a total of three double-clicks, and one press of the Palm's Hotsync button. Once that was done, and I'd clipped the Palm into the BackFlip and entered the unlock code that enabled the account, PocketMail was ready to run.

The acoustic coupler consists of a flat rubberised speaker, and a

small flip-up microphone that can adjust to fit pretty much any telephone handset. The flip-up assembly feels a little rickety to start with, but on further inspection, it turns out to be remarkably robust and flexible. It might not survive being sat on in the flipped-up position, but then you really don't want to be sitting on your Palm in any case.

Checking your mail is as simple as dialling the 1300 number, holding the unit up to the phone and pressing the PocketMail button (unmistakably marked with a small icon of a shirt pocket with a letter in it) A few squawks and bleeps later, your mail arrives, and... You know the rest, it's a fairly standard mail client, no surprises there. The application integrates well with the standard Palm address book, so you don't have to re-enter everything.

Consolidate yourself

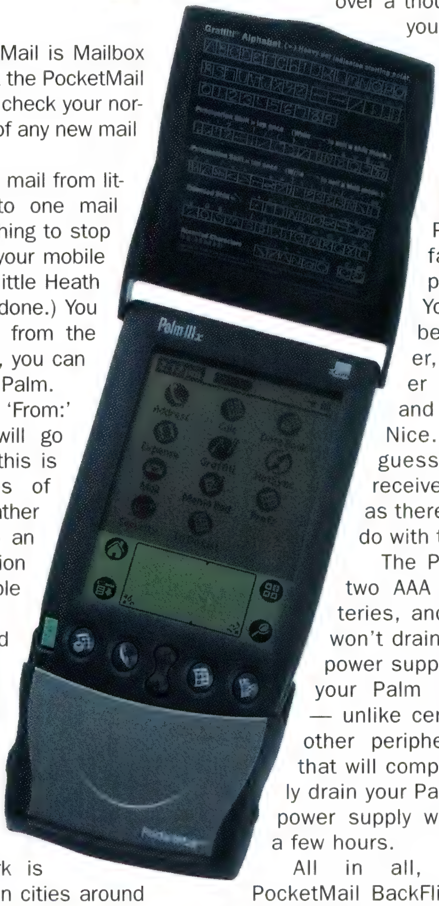
One downright handy feature of PocketMail is Mailbox consolidation. This basically means that the PocketMail server can be configured to periodically check your normal mail accounts, and forward copies of any new mail to your PocketMail inbox.

With this feature, you can check you mail from literally anywhere, without being tied to one mail account. (Yes, anywhere — there's nothing to stop you holding the PocketMail unit up to your mobile phone. It actually works... it sounds a little Heath Robinson, but it certainly gets the job done.) You have to set up Mailbox consolidation from the PocketMail website, but after you have, you can turn consolidation on and off from your Palm.

Along with the ability to change your 'From:' address manually, (so that replies will go straight to your normal mail account) this is perhaps one of the best features of PocketMail — it takes it from being a rather limited, almost 'toy' mail system, into an extremely useful remote access solution that wins out over most other portable mail systems.

There are mail-enabled phones and pagers out there, but they're expensive, and if you've ever tried to edit more than a dozen characters of mail on a mobile phone, you'll know the difference that a decent screen and input device makes. Of course, the Palm's Graffiti language isn't perfect, but it beats trying to enter text on a numeric keypad.

Access to the PocketMail network is international, with points of presence in cities around the world — and there's nothing to stop you dialling internationally, if it comes to that. There's a reasonable spam filter available to filter out the bulk of the rubbish, and with a 6000-character limit on messages (which sounds restrictive until you realise it's over a thousand words of plain text), you won't have to sit on the phone for hours at 1200 baud downloading the 3MB bitmap cartoon that someone so thoughtfully sent you...

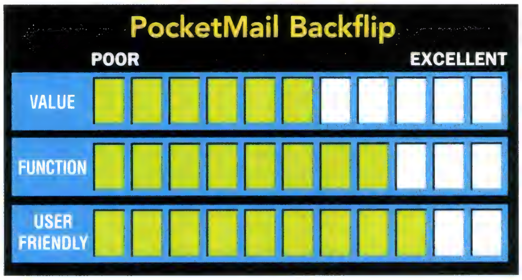


It faxes, too

PocketMail can also send faxes; perfect for your paper-obsessed contacts. You just enter the fax number into the address header, and the PocketMail server will render the message and fax it to the recipient. Nice. As you might have guessed, you can't actually receive faxes with PocketMail, as there'd be very little you could do with them once they did arrive.

The PocketMail BackFlip takes two AAA batteries, and so won't drain the power supply of your Palm Pilot — unlike certain other peripherals that will completely drain your Palm's power supply within a few hours.

All in all, the PocketMail BackFlip is a very acceptable solution to a ubiquitous problem. At under $199 for the unit and $19.95 a month for access, it's not exactly a fleabite, but other 'Lite' plans are available, and it could be just the solution you're looking for. If you have a Palm, and want to tackle all your emails on the beach, it's well worth looking into. ea



PocketMail Backflip	POOR										EXCELLENT
VALUE	🟩	🟩	🟩	🟩	🟩	🟩	☐	☐	☐	☐	☐
FUNCTION	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	☐	☐	☐
USER FRIENDLY	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	☐	☐

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Fax: Nat. 03 9888 1711 Internat. +613 9888 1711
Web: www.invent.com.au Email:kob@mem.com.au

Baseball, fatherhood, and a **weatherman stuck in time...**

Picture: ■■■■
Sound: ■■■■
Movie: ■■■
Bonus Extras: ■■■■

A LEAGUE OF THEIR OWN

Columbia, 1992. Directed by Penny Marshall, with Geena Davis, Tom Hanks and Madonna. Widescreen; colour, 122 min. SS/DL disc, Dolby Surround 4.0; Columbia TriStar Home Video, RRP $34.95.

■ Based on the true story of the All-American Girls Baseball League which ran in the USA during WW2, Penny Marshall's movie is as all-American as motherhood, baseball and apple pie can make it. Tom Hanks puts in a convincing performance as the boozy former league star employed to manage one of the teams, while Geena Davis plays the strong minded milkmaid turned star batswoman and team captain. Other team members are Madonna as the former 'dancer' from the Bronx, Lori Petty as Davis' young sister and Rosie O'Donnell as Madonna's tough friend. It's a well-paced 'feelgood' yarn, and Marshall captures the atmosphere of wartime America quite convincingly.

The image quality on this Collector's Edition DVD is very good, and the sound track is the same — although only Dolby Surround 4.0. There's quite a good selection of bonus extras, too: the original trailer, a short behind-the-scenes featurette, the original documentary that inspired the movie, a music video by Madonna, some bonus trailers featuring some of the movie's stars, some talent profiles and some still images as well.

In short the disc provides an excellent way to see this enjoyable, albeit slightly schmaltzy, all-American baseball comedy. (J.R.)

Picture: ■■■■■
Sound: ■■■■
Movie: ■■■
Bonus Extras: ■■■■

BIG DADDY

Columbia, 1999. Directed by Dennis Dugan, with Adam Sandler, Joey Lauren Adams, Jon Stewart and Cole and Dylan Sprouse. Widescreen (also full screen); colour, 89 min. DS/DL disc, Dolby Digital 5.1: Columbia TriStar Home Video, RRP $34.95.

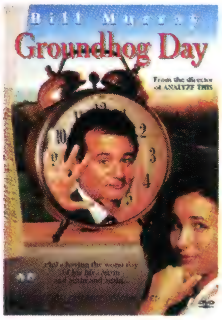
■ Adam Sandler (*The Wedding Singer*) co-wrote the screenplay for *Big Daddy*, and in it plays Sonny, a 30-something law graduate who seems to spend all his time in denial of his adulthood. Until his girlfriend deserts him for a wrinkly, that is, and then a five year old boy is dumped on him by the boy's dying mother — in the mistaken belief that he's the father. The rest of the movie is a 'light hearted' look at the way the two bond together, with plenty of toilet humour thrown in along the way. It makes OK viewing, but the somewhat flip approach makes it hard to get really involved.

The five year old is actually played by the identical Sprouse twins, by the way, and they're very good.

The picture quality in this Sony Gold Standard DVD transfer is excellent, on both the widescreen and fullscreen sides of the disc. The sound quality is also very good, too.

There's a reasonable amount of bonus extras on this Collector's Edition: trailers, a short 'behind the scenes' featurette, some talent profiles and music videos by Sheryl Crow and Garbage.

It's relaxing brain candy if you're in the mood, and the DVD certainly does it full justice technically. (J.R.)



Picture: ■■■■
Sound: ■■■
Movie: ■■■■
Bonus Extras: ■■■

GROUNDHOG DAY

Columbia Pictures, 1993. Directed by Harold Ramis, with Bill Murray and Andie MacDowell. Widescreen; colour, 97 min. SS/SL disc, Dolby Digital 2.0 surround; Columbia TriStar Home Video.

■ If you're not familiar with Groundhog Day, it's a nice old-fashioned 'romantic comedy', although a rather wierd one all the same — exploring the idea 'what if someone got trapped in a time warp and had to relive the same day over and over again'. It's interesting and thought provoking, albeit a bit irritating as well at times. Bill Murray plays — Bill Murray (as he always does), and was just the one to cast as the cynical, self-centred TV weatherman trapped in a rural town on February 2 ('Groundhog Day'), and Andie MacDowell is equally good as his producer and love interest.

The image quality is very good indeed on this Sony Gold Standard DVD transfer, and while the sound is also fine — it is only available as Dolby 2.0 surround. There's not a great deal in the way of bonus features, though; you just get the original cinema trailer, some talent profiles of Murray, MacDowell and Ramis and a few stills.

It's quite an entertaining movie, though, (if a little repetitive in places) and this disc would make an excellent way to see it. (J.R.)

Fixing TVs, and a font of **embedded knowledge**

FIXING TV SETS

TV FAULT-FINDING GUIDE, *edited by Peter Marlow. Published by Butterworth-Heinemann (Newnes imprint), 2000. Soft covers, 235 x 156mm, 373 pages. ISBN 0-7506-4633-0. Price in Australia $62.95.*

■ Readers familiar with the venerable British magazine *Television* will know that it regularly provides quite a lot of receiver servicing information — mainly reports from working service technicians, but augmented by material from the manufacturers as well.

This book is essentially a *Television* spinoff, collecting about 11 years' worth of this information together in convenient form for reference by anyone involved in servicing.

The information is all arranged by make and model, to make it as helpful as possible. And for service people in the UK, it should indeed make a valuable reference. However as many of the brands and models popular there are almost unknown here, it's not likely to be as useful in this country. For example I doubt if local techs have to worry much about Akura, Alba, Amstrad, Beko, Binatone, Bush, Decca, Ferguson, Finlux, Hinari, Rediffusion or Saisho sets, unless they've been brought over by migrants and modified for local reception.

There are likely to be a reasonable number of local brands and models covered, though, like Panasonic, Philips and Sony. So the book will probably still have some limited value for local technicians.

By the way there are no schematics, or even extracts therefrom. It's all text, with references to component numbers on the manufacturer's circuit, etc. So you'll still need service manuals for each set anyway, in the main.

The review copy came from Butterworth-Heinemann Australia, PO Box 146, Port Melbourne 3207. (J.R.)

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EMBEDDED KNOWLEDGE

THE ART OF DESIGNING EMBEDDED SYSTEMS, by Jack Ganssle. Published by Butterworth-Heinemann (Newnes imprint), 1999. Hard covers, 160 x 242mm, 245 pages. ISBN 0-7506-9869-1. RRP $110.

■ We get a fair few books coming through the doors at EA, and occasionally there's one that you are tempted to slip into your briefcase to 'review at home'. As you might have guessed, Ganssle's *The Art of Designing Embedded Systems* is one such book, and one that shall reside on my bookshelf until I'm old and grey...

Ganssle is a well known figure in embedded design circles, and has been contributing editor for *EDN* and *Embedded Systems Programming* magazines, as well as speaking at embedded design conferences around the world.

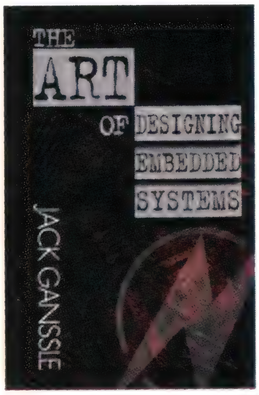
Simply put, the book is joy to read. Ganssle covers every aspect of embedded design from the benefits of using ISRs over polled routines, to estimating the amount of stack space your design will need. Once you are lulled into a sense of security with flow charts and voltage levels, he leaps in with deep, painful questions on the effectiveness of your time management strategy, and version control.

In fact just over half the book is aimed at making you a more efficient programmer by making you look at how inefficiently you work. "Any idiot can write code", he says, and he's right — what's important is that you write code that works, and to do that, you need to manage yourself, and the project as a whole.

Ganssle's methods are quite easy — little things like turning off your phone and email while you are coding, and doing the bulk of your work during your most productive time of the day. Of course, you'll find these sorts of points covered in any self-help book, but when they come interspersed with chunks of C++ code, and warnings to check the duty cycle of your CPU, you can't help but to take them all to heart.

The Art of Designing Embedded Systems is an impressive book, written in an engaging style by someone who knows his subject inside out. If you program any form of microprocessor, or think that you may possibly do so in the future, I say to you: buy this book. It will change the way you code, the way you manage the project, and I dare say it will change your life as well.

The review copy came from Butterworth-Heinemann Australia, PO Box 146, Port Melbourne 320, and is thoroughly recommended! (G.C.) **ea**



MOFFAT'S **MADHOUSE**

BY TOM MOFFAT

Sorry, **parts not available...**

YOU'VE PROBABLY HEARD me talk about the big stage sound system I bought some time ago. It's 'almost' earning its keep now with a constant stream of gigs throughout the year. This past week was a record: four gigs in a space of eight days.

Part of this activity was as a result of Jazz Port Townsend, an annual festival drawing participants from all over North America. There are workshops led by household-name jazz stars, major concerts, and then the whole thing splits into mini-concerts in the local pubs; nine of them going at once this year.

My job was doing sound in a nice venue called Cheeks Bar and Bistro, working with a quartet led by a guy on baritone sax. These gigs didn't even start until 10:00pm, awaiting the finish of the major concerts. And they went on, officially, until 1:00am. All went fairly well, given some handicaps I had to work under.

Last Sunday, following four hours sleep, I had an outdoor gig — Music on the Green, outside a very exclusive beach club in a very exclusive and wealthy retirement community named Port Ludlow. There were three bands playing five sets over five hours, and all microphones, foldback speakers, and power cables, had to be rearranged for each one of them.

Whenever possible I like to use the 'direct input' method instead of microphones to take sound from things like guitar and bass amplifiers, or keyboards. I don't use an official DI box; instead I use a line-mounted high-impedance-unbalanced to low-impedance-balanced transformer, with a quarter-inch phone plug on one end and an XLR connector on the other. The XLR connects to a standard microphone cable feeding into one of the inputs on my Mackie mixer. These inputs can be trimmed over a range of 60dB, so they can handle just about any level, mic or line, that you care to feed to them. With 'passive DI' there are no batteries to go flat, nothing to break. It's a very reliable system. Mostly.

With two of the bands that day we used one of my passive DI gadgets, hooked to a keyboard output, with a fair chunk of sound coming back through the foldback so the musician could hear what he was playing. The line-matching transformer was lying on the concrete patio in front of the stage, and as we were moving microphones around I gave the transformer a little shove with my foot to move it under the stage. And thereupon erupted from the foldback system a most enormous roar of crashes, grunts, and groans.

One of the musicians said, "I'll bet you got that from Radio Shack, didn't you..." It is true, I did, because there is simply nowhere else in my town to buy electronics stuff. Or in the town 45km from here. Or the town another 20km beyond that. Each of them have their Radio Shacks, but nothing else. The nearest proper 'parts house' is nearly 160 km away in Olympia.

This is not meant to sling off at Radio Shack, but to point out some deficiencies that really need attending to. Radio Shack TV antennas, for instance, are first-rate; at least the ones available in this country. Most of their other stuff is pretty OK, but when we come to audio connectors, YUCK! Some changes are definitely needed.

Dodgy Cables

A couple of years ago I was hired to build the local community TV station, and even though that sounds like a big-deal thing, most of the work was running cables and hooking them up to stuff in equipment racks. Video cables were no problem; the major equipment supplier in Seattle threw them in with the stuff he sold. But for audio cables, we had to fend for ourselves, at Radio Shack.

One would expect 600 ohm balanced lines running around a TV studio, but in reality most of our audio was high impedance unbalanced, fed through the familiar RCA connectors. We ran full stereo audio, so signals such as videotape to routing switcher were fed with ready-made stereo RCA cables of varying lengths.

We had these things coming right out of their sealed packets with one side dead. We thought it might be more profitable to buy a roll of shielded mini-cable and separate RCA connectors, and make the cables ourselves. But many of the connectors proved faulty. Eighth-inch phone plugs were the same; their "tip" part was press-fitted to its solder lug, not soldered, and these broke down frequently.

It seems a major cause of the problems might be cor-

rosion, and lack of protection against it. Port Townsend is surrounded on three sides by sea water, at a distance of less than 4km. So corrosion is a big problem, and not just with electronics. Some of the connectors we get won't even take solder. As for those line-matching transformers mentioned above, you can grab hold of the phone plug and jiggle it, and produce crackling noises in the speakers every time.

It's important to note that not all line-matching transformers are that way. The Shure company, known for their microphones, makes line transformers electronically identical to the Radio Shack versions. But the Shure ones don't crackle and pop. Shure transformers do exist in this town, but only in the one and only music shop which, having no competition, can charge like a wounded bull. I did buy one Shure transformer, tried it out, liked it, and then lost it somewhere the following week. I guess one solution to the problem would be to track down the Shure transformers on the internet, at the right price.

Lucky Australians

You people in Australia and New Zealand don't know how lucky you are to have access to companies such as Altronics and Jaycar and Dick Smith with branches in your own towns. And locally, even in little Hobart, there are places like Active Electronics supplying professional quality goods instead of bottom-of-the-heap consumer grade.

At one stage while I was running a business in Hobart, I had access to at least four local professional grade electronic suppliers. Compare that with Seattle, where there might be only one or two places where you can actually walk in with some money and walk out with a handful of professional-quality adapters, or connectors, or anything!

INVESTIGATION OF THE CABLE REVEALED SOME INTERESTING TECHNOLOGY.

There are also some rather curious design techniques on this side of the world, for electronic items sold at retail. A few weeks ago, long after my job at the TV station vanished, it was decided to equip the city council chambers with a fleet of wireless microphones, one for each councilor and bureaucrat, so they wouldn't have to contend with the inconvenience of microphone cables. This wireless system replaced a previous group of lovely Audio Technica studio microphones, mounted on goosenecks, at each councilor's desk. That was a fine, professionally-designed system, and I thought it was a silly idea to replace it. But the job went ahead, supervised by the TV station administrator since the meetings were televised live.

In the previous system, the desk microphones fed into a 12-channel mixer, which then fed two independent amplifiers. One, with a 600 ohm line output, fed sound to the modulator that sent the council proceedings back to the TV studio. The modulator was at the back of the room, so a 20 metre shielded balanced cable was needed to connect with the line amp at the front. The mixer also fed a small PA amplifier that drove wall-mounted speakers for the audience.

All this older stuff was tossed, and replaced by a 16-channel Mackie mixer and another PA amplifier. The older equipment had screw terminals for the output of the line amplifier, but the new mixer only had 1/4 inch and XLR connectors. So our installation crew went to Radio Shack and bought a 15 metre speaker cable (unshielded) and a 1/4 inch to XLR adapter. NOT a line transformer, but an adapter cable. Since the modulator only had screw terminals, they chopped off the XLR connector and connected the wires directly.

"Fix it, Tom!"

Eventually I got a phone call: "Tom, please, get down here quick! The council meeting is only an hour away, and we can't make this thing work!" And sure enough, when I got there the modulator was emitting lots of hum and nothing else. Investigation of the dismembered adapter cable revealed some interesting technology. The XLR end was wired for balanced all right. But within the cable's 1/4 inch plug, one side of the balanced line was connected to ground and the other side went to the tip.

This meant that any concept of 'balanced' was totally negated, and combined with the unshielded speaker cable, the audio quality was rather unsatisfactory to say the least. And the circuit probably played merry hell with the mixer's output, too.

The photo shows both ends of this interesting adapter, displayed beneath a correct line matching transformer which it is meant to replace. What is surprising is that a multi-national company would sell a device that is so totally, technically, wrong. I wonder who designed it? It wasn't a haywire job; the connections within the 1/4 inch plug are nicely sealed with potting compound, and the plug itself is of the expensive gold-plated variety.

Many sound mixers feature phantom power, which is a voltage impressed between the two balanced lines and ground, to power condenser microphones. This adapter cable would completely short-circuit the phantom power, for that channel at least.

Technical readers might get a good laugh out of this goofy adapter, but this is the kind of thing we have to put up with all the time over on this side of the world. I just wish there were a practical solution to it. Anybody want to come over here and start a decent parts house? ea

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OVERNIGHT DELIVERY

Speed Dome Cameras

NEW

These 1/3" Speed Dome CCD Cameras have built in Pan and Tilt motor drives. Panning angle is 355°, tilting angle is 80°, pan/tilt speed is 15° sec. Pan/Tilt is controlled by a remote controller, which even has a wireless remote control. Ideal for surveillance for retail stores, parking areas, foyers, etc, etc where a stationary camera will not see the whole area. Up to 4 cameras will operate from 1 controller unit. Available in both colour and black & white. Mini size - only 110(H) x 125(dia.)mm. Each camera is supplied with a 20 mtr. connecting cable using 6 pin mini din plugs. Extra cables and joining adaptors available. Controller required to operate.

Black & White

NEW

Includes Dome Camera, mounting hardware and 20 mtr cable (6 pin mini DIN plug to plug) and instructions. Note: You need a controller Cat. QC-3200 to operate.

Cat. QC-3210 **$549**

Colour

NEW

Colour version of B & W, as detailed above.

Cat. QC-3215 **$749**

Image Sensor QC-3210:	1/3" CCD B/W
Image Sensor QC-3215:	1/3" CCD Colour
Pixels:	512 x 582
Resolution QC-3210:	380 TV lines
Resolution QC-3215:	330 TV lines
Min Illumin. QC-3210:	0.1Lux
Min Illumin. QC-3215:	2.0 Lux
Microphone:	Electret
Lens:	3.6mm
Synchronization:	External
S/N Ratio:	48dB
Camera Power Input:	From Controller
Panning Angle:	355°
Pan/Tilt Speed:	15f/Sec
Tilting Angle:	80°
Size:	110H x 125 Dia

Controller to Suit Speed Domes

NEW

To operate a speed dome, you require this controller. It will accept up to 4 speed dome cameras and has an output for video out, audio out and monitor out. Controls for each camera is up, down, left & right. Also includes an infra red wireless remote control. Supplied with 1.25A 12VDC switchmode mains power pack **Cat. QC-3200**

Only $249

Extension Leads for Speed Domes

NEW

20 mtr. 6 pin mini din plug to plug.

Cat. WQ-7274 **$39.95**

Adaptor to join cables - 6 pin mini DIN female/female.

Cat. PA-0878 **$6.95**

WE WILL NOT BE UNDERSOLD ON SURVEILLANCE EQUIPMENT

2.4GHZ 1/3" WIRELESS COLOUR CCD CAMERA AND RECEIVER

NEW

This wireless colour CCD Camera and Receiver is packed with features. These include: •Camera supplied with adjustable 1/3" 6mm lens •Camera will run either on 8 - AA batteries which fit in the camera housing, or the mains plug pack supplied. •Bracket supplied to mount camera, which can be fitted either on top or underneath camera. •Camera has built in microphone for one way sound •Range is up to 100m in clear position •Receiver has RCA audio / video outputs to monitor. Specs: •Pixels: 512 x 582 •Resolution: 330 TV lines, •Min Illumination: 1 Lux •S/N Ratio: More than 45dB •Built in Mic: Electric condenser •Video/Audio Input: 1V p-p •Len: C/CS mount

Cat. QC-3440 **$699**

Fog Machine

Available early October

NEW

Our fog machine produces clouds of white fog on demand and has a remote fog control switch and is an excellent companion to our mirror balls and party lights. The unit includes a bracket for overhead mounting & operates on 240VAC. Specifications: •Heater power: 700 watts. •Warm-up time: 4 minutes •Tank capacity: 800ml •Output: 25ml/min.

Cat AF-1200 **$165**

Fog Juice

NEW

Specially formulated to exclude oil or grease, our fog juice is water based & much more environmentally friendly than inferior fluids containing oil. •5 litre bottle **Cat AF-1205** **$35**

Subwoofer Amplifier Bargain with Remote Control

150 Only

240W RMS

SAVE $$$

Last month we advertised our new 240W RMS / 4 ohm amp module, which is the same price as our old 150W RMS model - $319. This month, we have an even better deal. We have 150 pcs. only of the 240W RMS Amplifier with a remote control for only $10 more!! The remote control normally ads $50 - $60. •Continuous output power: 240W RMS into 4 ohms & 150W RMS into 8 ohms •Frequency response: 20 to 160 Hz •Adjustable crossover: 50Hz to 160 Hz •THD: <0.1% •Distortion: <0.2% •S/N ratio: >100db •Bass boost: 6db @ 35Hz •Input sensitivity @ max vol:150mV •Line out: 180mV @ max vol. •Power requirement: 240V 50Hz **Cat. AA-0506**

BE QUICK, STOCK WON"T LAST! **Only $329**

Panasonic Colour Dome Camera

NEW

Brand new dome camera with a Panasonic CCD sensor, 380 TV lines, 2 LUX min illumination, ultra low current consumption - 80mA, 87mm dia.

Cat. QC-3487 **Only $259**

Inline Surge Protection

NEW

Protect your valuable computer, hi fi, laptop, fax, equipment with one of our great new inline surge protectors.

IEC Style: Fits standard IEC C13 to C14 power connectors as used on most desktop PCs, monitors, scanners, fax machines and many other equipment. Includes power light & warning buzzer. MS-4012 **$37.95**

Figure 8 Style: Suits most notebooks, hi-fi equipment and video recorders with a standard IEC C7 to C8 figure 8 connector. Includes power on indicator. MS-4014 **$27.95**

Cloverleaf Style: Suits the IEC C5 to C6 cloverleaf connector used on some IBM, DELL & Apple Mac notebook computers. MS-4016 **$37.95**

4 Way S-VHS Switch Box

NEW

This switch box allows you to connect up to 4 devices, and switch between them, to 1 output to a TV etc. Switch also includes RCA sockets, and a 3.5mm headphone socket.

Cat. AC-1664 **$39.95**

32V 150W Halogen Swimming Pool Light

Are you sick and tired of paying well over $30 for a replacement globe for your swimming pool light? We certainly were! So we've done something about it. Attention Pool Shops and bulk users - Contact our Wholesale Dept. for fantastic prices for quantity buys. Cat. SL-2725

Super special only $12.95ea or 5 for $50. Were $24.95 each

SAVE $12

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TV Headphones

Features 5 metre extra long cord with individual volume control, mono/stereo selector switch and a gold 3.5mm plug with gold 6.5mm adaptor.

Cat. AA-2002 $10.95

Lightweight Heavy Bass Stereo Headphones

Designed for extra bass performance. Fully adjustable headband and speakers for greater comfort. Supplied with 3.5mm plug and 6.5mm adaptor.

Cat. AA-2007 $14.13

PHONE/MAINS FILTER MADNESS

Grab one in October, and save. 1 month only at this low price.

6 Outlet

6 mains sockets and one phone socket - RJ45, with RJ12 adaptors. Includes on/off switch and circuit breaker, surge protection etc. See Cat. page 157 for full details.

POWERTECH

Cat. MS-4035

Oct. $35

SAVE $8.25

Jaycar will match or better the price of any product our competitors sell, of same quality. Sale Prices Included.

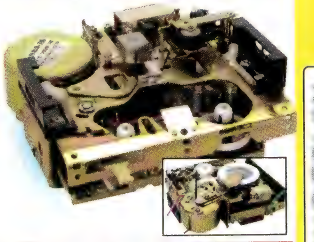
FIREWIRE CABLES NOW AVAILABLE

NEW

Firewire is a new high-speed serial bus standard which bridges the world of consumer electronics and computers. Allows users to attach camcorders,VCR's, DVD and other audio/video components to their computers and printers.

4 Pin to 4 Pin	Cat WC-7640	2 mtr	$25.95
4 Pin to 4 Pin	Cat WC-7641	5 mtr	$39.95
6 Pin to 6 Pin	Cat WC-7644	2 mtr	$19.95
6 Pin to 6 Pin	Cat WC-7645	5 mtr	$29.95
6 Pin to 4 Pin	Cat WC-7647	2 mtr	$22.95
6 Pin to 4 Pin	Cat WC-7648	5 mtr	$32.95

CAR STEREO CASSETTE MECHANISM **AN EXPERIMENTORS DELIGHT**



Limited quantity. These are brand new, and are made in Japan under licence from Staar, Belgium. They feature a stereo head, fast forward, reverse and auto eject. Specifications: Tape speed 4.75cm/s; Wow and flutter 0.25%rms: Size 200(D) x 205(W) x 40(H)mm approximately. We supply basic information with the mechanism.

Cat. AR-1500

Only $9

BUY 10 LESS 10%

Velleman 5mhz Scope

We won't be under sold!

Some features: •High contrast LCD with wide viewing angle •Full auto set up for volt/div and time/div •Trigger mode run •Normal on/off •Slope -/+ •True RMS & dB measurements •Readout: Vdc - Vpp, Vrms - dBm

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Cat. QC-1906 Only $299

12VDC Quick Charger for 7.2V/8.4V Battery Packs

SAVE $10

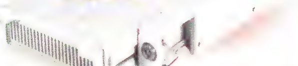
Features: For batteries 600 to 2000mAh. Auto cutoff. Timer to prevent overcharging. See Cat. page 148 for full details. **Cat. MB-3515**

Cat. Price $39.95
October $29.95

Removable IDE Hard Disk Drawer with Power switch

NEW

Both with 3 fans



This handy unit allows you to easily remove the drive from the computer and place it in your safe. The drawer allows you to move large amounts of data between computers with a minimum of fuss. It has 3 cooling fans and a clever locking system with power interlock switch that permits the drive to be removed without turning off the computer. The drawer fits a standard 5.25" drive bay and will support all 3.5" IDE/ATAPI devices. **Cat. XC-4671**

$39.95

IDE Mobile Hard Disk Drawer

STANDARD Cat. XC-4670 $28.75

Computer Fans

AMD K6/Cyrix CPU Heatsink & Fan Cat. XC-5053 **$16.95**

3 Wire 12VDC Fans

Third wire produces a 1 pulse per revolution output

40mm Cat. XC-5054
50mm Cat. XC-5055
$13.95 each

1500MCD 5mm White LEDs

Voltage 3.5V.
Current 20mA.
Cat. ZD-1786
$3.95

Super Drill / Engraver

Ideal for professionals or hobbyists. Kit includes the drill with variable speed control, a box of different grinding stones, wheels, bits and brush, a 240V to 15V plug pack and a case to house it all. See Cat. page 63 for full details. **Cat. TD-2470**

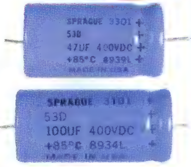
Was $99 Oct $89

SAVE $10

Sprague Capacitor Specials

NEW

These high voltage RT Sprague Electrolytic Capacitors are made in the USA and are quite rare.



47µF 400VDC
Cat. RE-6780 $3.95ea

100µF 400VDC
Cat. RE-6784 $4.50ea

NEW BOOKS

NEW

PIC Microcontroller Project Book

NEW

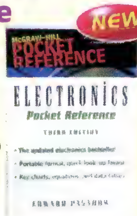
Beginners guide to the PIC. Softcover 203 pages.

Cat. BT-1340
$49.95

Electronics Pocket Reference

NEW

Packed with data tables, charts and equations. 529 pages.



Cat. BT-1330
$29.95

Programming and Customising the PIC Micro

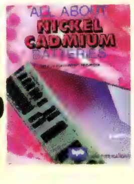
NEW

A tutorial with a CD supplied as well. 351 pages.

Cat. BT-1344
$79.95

All About Ni-Cad Batteries Book

See Cat. P281
308 pages.
Cat. BM2485
Was $29.15
Now $20



SAVE $9.15

Speakers for Musicians Book

See Cat. P275.
164 pages.
Cat. BB-7030
Was $17.55
Now $12.50

SAVE $5.05

33 DRAWER PARTS CABINET

This unit is very large! There are six rows of 5 drawers, all the usual size. There are 2 drawers that are half the total width each, and the bottom row has one unbelievably large drawer. Total size is 295(W) x 125(D) x 355(H)mm.
*Does not come with dividers.

Cat. HB-6321
Was $26.95
October $20
Or Buy 4 for $60

SAVE $47.80

PLUG PACK BARGAINS

STOCK UP AT THIS PRICE.

9VDC 850mA
Supplied with 1.75mm output plug
Cat. MP-3009

10VDC 850mA
Supplied with 1.75mm output plug
Cat. MP-3004

Catalogue Price $14.25ea.
October $9.50 ea.
Buy 10 mixed $7.50ea.
Buy 100 mixed $6.00ea.

Unidirectional Pro Mic

SAVE $17

Ideal for theatre, night clubs, schools, etc. Can be converted to balanced, with cannon lead. Includes 6m lead to 6.5mm plug. 600Ω, Freq: 60-12kHz, Sens: -76dB ±3dB **Cat. AM-4094**

Was $56.95 Oct. $39.95

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Car Sub Deal

This deal consists of our 12" Re/sponse Subwoofer in a cabinet and our 2 x 84WRMS Car Amplifier, which gives 234WRMS in bridged mode.

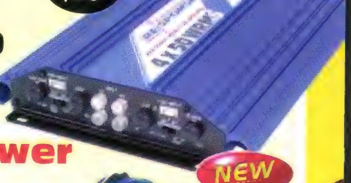
12" SUBWOOFER Cat. CS-2540	**$259**
84WRMS X 2 AMPLIFIER Cat. AA-0432	**$199**
NORMALLY BUY TOGETHER FOR	**$458**

October Special $399

RE/SPONSE

SAVE $59

4 X 50WRMS CAR AMPLIFIER



4 x 50WRMS/4Ω, 2 x 150WRMS 4Ω. See Cat. page 104 for full details. Cat. AA-0438

SAVE $30

Was $249
Now Only $219

RE/SPONSE

2 Door Car Power Door Lock Kit

NEW

At last, a central locking kit for 2 door cars. Comes supplied with 1 master and 1 slave actuator, control relay, hardware and wiring and rubber boots.

Cat. LR-8838 **$39.95**

CAR SOUND WAFER FUSES/HOLDER

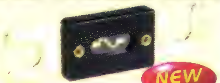
Wafer fuses are designed for really high current applications, and are screwed down offering better conductivity.

INLINE FUSEHOLDER WITH MOUNTING BRACKETS

NEW

This fuseholder has gold plated contacts and will accept both 4GA and 2GA cable. There are 2 "O" rings to keep moisture out as well as grommets each end. Clear construction. Size 145(L) x 32dia. excluding brackets. Accepts wafer fuses. Cat. SZ-2075 **$39.50**

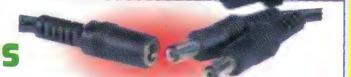
GOLD WAFER FUSES



NEW

80 Amp Cat. SF-1990
100 Amp Cat. SF-1992
150 Amp Cat. SF-1995
$9.95 each

CCD DC POWER SPLITTER LEADS



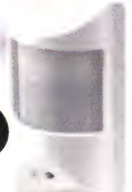
Allow you to run two CCD cameras from one power supply. Consists of a 2.1mm DC Plug to 2 x Skts. 2 lengths available.

NEW

200mm Cat. WQ-7280	**$8.95**
2 metres Cat. WQ-7284	**$11.95**

SURVEILLANCE DEALS!!!

CCD Camera in a PIR Case



Looks like a real passive infra red detector in a burglar alarm. Black and white camera, also includes audio. See Cat. page 126 for full details. Cat. QC-3479

Cat Price $124.10
October Only $99

SAVE $25.10

Panasonic 1/3" Colour CCD Camera

Includes audio & auto iris option. Requires C/CS lens. Cat. QC-3302

Was $329
Oct. $299

SAVE $30

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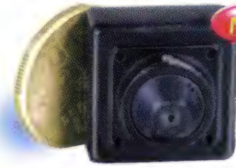

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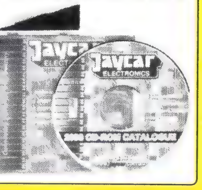

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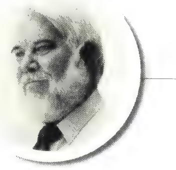

OPEN **FIST**

BY STEWART FIST

Conventional Wisdom

I'M GOING to write this month about apples. And I don't mean the beige plastic/electronic type I'm writing this article on, I mean the apples you eat.

It's not that apples have any protective powers against potentially harmful EMFs or anything like that, it's just that the great Alar scare of the early 1990s has some very strong parallels with current cellphone fears.

Most readers will probably remember these as facts:

- Alar was a chemical applied to preserve apples.
- American activists beat up a story that Alar was highly carcinogenic.
- The story appeared on the CBS *60 Minutes* program and 50 million Americans panicked.
- Hundreds of millions of dollars worth of apples were dumped because people refused to buy them.
- Tests were then done, and Alar turned out to be harmless.

This is the conventional wisdom, and it certainly is the way the Alar scare is treated by the world press. And it is almost totally wrong.

But this was also my understanding of the Alar problem until a few months ago. At the time I was writing about the way science was systematically distorted by PR operators around the world, and Alar was often quoted as an example of activist-promoted junk science.

This impression is only partly right and it results from a confluence of three forces.

1: There was a political dimension. The Alar scare followed a long period of Reaganism in the USA where the health and environmental regulators (EPA, FDA and OSHA) had been blocked from taking precautionary positions.

2: There was organised crisis-mongering by a small group of activists who despaired at getting US regulators to take action over what they believed to be a low-level, long-term carcinogen in the food chain of children.

3: Their actions were followed immediately by a better-funded reaction from the food industry. They hit back at the activists, spending a small fortune countering the exaggerated charges with their own long-term campaign of disinformation.

All sides of this dispute conducted their campaigns with little regard for the truth — and the media didn't help much either.

As a result, the suckers (the public) and the scientists were left with the smoke of numerous verbal fires wafting over the battlefield, obscuring everyone's vision. What lingered longest in the minds of the media was the whiff of industry's smoke. They had more money, and could manufacture bigger and better smoke-pots.

After a temporary down-turn in consumption lasting only weeks, Americans went back to eating apples again. The stories about orchardists going out of business, and $US375 million dollar industry losses, were total fiction.

Strong parallels

I see some very strong and quite obvious parallels here with the on-going battle between EMF activists and the mobile telephone industry. In fact, I came across the Alar story because I've been systematically tracking shonky scientists, cash-for-science promoters, and idiot science-journalists, who have been recruited or persuaded to support the cellphone industry claim of 'No possible danger'.

I kept stumbling across the same names working for the tobacco industry in its battle over passive smoking restrictions in the workplace, and then later in the Alar crisis. I've long been aware that there was a strong organisation of lobbyists centred on Washington DC, which counters all attempts at industry health regulation. And they apparent have many scientists available to produce results which match pre-written reports. But until recently, I hadn't realised how large, powerful, and well-funded this process was, or how it crossed industry boundaries.

To be fair, there's also a well developed industry running activist campaigns around the globe, but this is only funded to the tune of a few million dollars; the corporate corrupt science and lobbying must cost billions.

Here's what happened in the Alar crisis, just so that you can see how the 'conventional wisdom' came to be conventional.

Alar was invented by Uniroyal and since the 1970s it has been flogged to apple growers for ripening inhibition. The spray makes all the fruit ripen simultaneously, which reduces picking costs and allows some apples to be sold out of season.

In 1984 the EPA's National Toxicology Program came to the conclusion that Alar broke down into a chemical called UDMH which, in combination with Alar itself, resulted in a significant increase in cancer rates over an average consumers' lifetime.

The EPA therefore classed it as a 'probable human carcinogen' and apple sales briefly dropped about 30 per cent. But then people forgot, and sales recovered.

The EPA sets a base-line standard of one-per-million increase in cancer for environmental contaminants or food chemicals. This assumes an average exposure over a lifetime and average human sensitivity. Findings above this calculated cancer rate mean that the EPA will survey the substance regularly and might ban it if it is widely used. Below the level, the chemical is ignored.

The threshold is based on high-dosage mouse studies, and it assumes averages. So some people will be more sensitive and some will get higher doses. However the one-in-a-million lottery is generally considered to be achievable with most alternative technologies/chemicals, and it is a precautionary judgement, not a level of absolute proof.

In 1984 the EPA decided that risks associated with the Alar/UDMH combination were at a level of 50 in a million, but this was in the midst of Ronald Reagan 'Star Wars' program where science was expected to solve every problem, and health and environmental regulations were suppressed.

So the EPA held talks with Uniroyal who promised to stabilise the chemical so that it didn't break down so readily, and reduce the recommended application density.

In 1987, the EPA tested Alar again and concluded that it was now at a level of only 20 in a million. And since the situation was improving, they did nothing again — until the story broke.

The EPA wasn't acting in isolation. Two US states had already banned Alar, and some major food store chains were refusing to buy Alar-treated apples.

In fact, prior to the 60 Minutes program in February 1989, five separate, peer-reviewed studies had found a correlation between exposure to the chemicals and cancerous tumours in lab animals.

Then an activist group called the Natural Resources Defence Council (NRDC) decided to force the EPA to take action. They conducted a quick and dirty research project, feeding massive amounts of Alar to mice at levels which were probably toxic rather than carcinogenic. So the mice dutifully keeled over in large numbers.

Maximise embarrassment

Ralph Nader and actress Meryl Streep were then recruited to support the campaign, and they hired an aggressive public relations firm called Fenton Communications to maximise the EPA's public embarrassment. Fenton gave the story-exclusive to 60 Minutes and set up a series of embargoed newspaper and magazine briefings. Talk-shows were contracted to allow Nader and Streep to ride on the coat-tails of the program's airing.

The opening line of the CBS program was: "The most potent cancer-causing substance in our food supply is sprayed on apples to keep them on the trees longer and make them look better."

Actually Alar is probably only a low-level, long-term carcinogen in humans (no one really knows for sure), and there are possibly hundreds of other chemicals in our environment with equal or greater potency. But that doesn't necessarily mean we want Alar just for the convenience of fruit pickers.

But the media sensationalism gave the food industry just the weapon it needed to counter-attack. It had no problems at all finding hundreds of biomedical scientists willing to condemn NDSC's set-up mouse study using such toxic levels. And by extrapolating from these high doses the PR spin-doctors were able to claim "that a person would have to eat 28,000 pounds of apples a day for a lifetime to be at risk. "

Neither side could then admit that these risk figures were for Alar poisoning — not for cancer. Yet cancer risk has no known relationship with toxic poisoning, so both sides used the same mis-information to further their own ends.

However for industry lobbyists this confusion generated a saleable slogan which allowed the conservative press to have a field day at the expense of the activists. So the impression remains today that the Alar scare was nothing but irresponsible crisis-mongering.

The EPA's original research remains valid and it's stance has since been confirmed and supported by the National Academy of Science and the World Health Organisation. WHO did their own animal tests; the US Consumer Union also conducted tests; and Uniroyal finally admitted that 22 percent of the mice given a high dose of the chemical in their own trials, developed cancer even before the study was half completed.

Yet in 1990 the American apple-growers took CBS to court in a trial 'food-libel' action. Their claims were thrown out by federal courts at both the district and appeal levels as having "no basis in fact", and this ruling was upheld in 1996 by the US Supreme Court.

But the conventional wisdom — as preserved in newspaper files — remains that Alar is not carcinogenic, and that the whole scare had been nothing more than an activist beat-up.

Alar is still classed as a "probable human carcinogen" by both WHO and the EPA, and Uniroyal withdrew if from the US market voluntarily (while still selling it overseas).

That's how conventional wisdoms are generated — on both sides. **ea**

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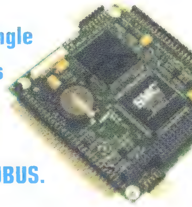

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CONDUCTED BY JIM ROWE

But WHY did LIPDs have to go on 434MHz Repeater frequencies?

This month we're still talking about those very low power 434MHz walkie-talkie transceivers which were recently released in Australia as part of the ACA's class licence for 'low interference potential devices' — or LIPDs for short. As mentioned last month I was able to get some information from the ACA regarding the reasons for allocating these transceivers frequencies with the potential for interfering with amateur repeaters...

YOU'LL HOPEFULLY RECALL from last month, when I presented some of the letters responding to my June column criticising the way some radio amateurs had abused retailers for selling LIPDs, that probably the main reason amateurs were angry was that some of the frequencies allocated to these devices in the 434MHz band were already in use for amateur repeaters. The common cry was: 'Why couldn't they have been allocated different frequencies?'

Some correspondents seemed to be suggesting that the frequencies had been chosen with no regard for their interference potential, or else deliberately and with the idea of causing maximum irritation to amateurs! Even from my own limited knowledge of the ACA and its professional approach to spectrum management, both suggestions seemed most unlikely — quite apart from revealing a possible streak of paranoia in those who made them.

I suspected that in reality there'd be much more logical and balanced reasons for the choice of frequencies, so I contacted the ACA with the idea of discovering what those reasons might be. And I was lucky enough to be able to talk to Mr Len Bray of the ACA, who took great care to explain how the choice of frequencies had actually been made.

As you might perhaps expect, and despite what some of the amateurs have suggested, it's not a situation where everything was simple and straightforward. Quite the reverse, in fact. As with much of the spectrum planning and management work carried out by both the ACA and its counterparts around the world, there were many aspects that had to be considered — and with some of them competing with each other, by their very nature.

Mr Bray explained that in broad terms, the ACA's class licence for LIPDs was a response to growing pressure around the world for spectrum space to be made available for the use of a wide variety of low-power devices based on electromagnetic radiation. The very low power communications transceivers are in fact only one of many such devices, because the LIPD category includes wireless remote controls, wireless audio links, security system interrogation links and 'swipe free' ID cards, personal safety alarm transmitters, animal tracking transmitters, transponder systems for product and/or vehicle identification and tracking, wireless data loggers and so on.

Modern society has found many applications for such devices and systems, and bodies like the ACA have been charged with the responsibility of making spectrum space available for their use — in ways which have the least impact on existing spectrum uses and users. That's why over the years the ACA and similar bodies have searched the spectrum and found dozens of tiny chinks and slivers, which they've decided could be made available for some or all types of LIPD, with minimal disturbance to other spectrum users.

Anyway, with regard to the low-power UHF handheld transceivers, there has been pressure globally to make more spectrum available for these 'low priority communications' devices. And in quite a few countries, regulatory bodies like the ACA have found spectrum slivers for them within bands which have previously been allocated for 'ISM' (industrial, scientific and medical) use.

Now in most of Europe, a small band of frequencies around 434MHz has long been allocated for ISM use, and the regulatory bodies there made some of these frequencies available to use the new short range 'walkie talkie' transceivers. As a result manufacturers began producing models designed to operate on these frequencies, and the devices proved both practical and popular — fueling the demand for similar devices in other countries.

This posed something of a problem for the ACA, despite also being under pressure to provide spectrum space for such devices. In countries like Australia and North America, the nearest ISM band in this part of the spectrum was up near 900MHz. But the ACA knew they wouldn't be able to allocate any space for LIPDs in *that* part of the spectrum, because it had already been allocated here for use by the large number of mobile phones using the GSM system.

Inevitably and for various reasons, the next part of the spectrum to consider for LIPDs was the area around 430MHz. In Australia this has not previously been an ISM band, but the whole 30MHz band from 420MHz to 450MHz has been shared between a number of services, none of which have used it in what could be called a 'continuous' or 'saturation' manner. The primary use was for what the ACA calls somewhat obtusely 'radiolocation' — i.e., radar, and primarily by the military. All of the other users have 'secondary' status, and include both radio amateurs and both fixed and mobile point-to-point radio communications users.

It seemed likely that a small slice of this band could indeed be allocated for use by LIPDs, if their maximum EIRP (effective isotropic radiated power) output was restricted to a suitably low level to lower the risk of interference with both the primary and secondary users to an acceptable level. So the ACA's technical people and spectrum analysts did their sums, and concluded that if they limited the EIRP to 25 milliwatts, there would be a very low risk of interference from them.

OK, so that was the rationale behind including a small band in the 420 - 450MHz area for use by devices covered by the LIPD Class Licence. But why choose the specific frequency range 433.05MHz to 434.79MHz?

Well, the fact is the ACA knew that this was the band allocated for these devices in Europe. They also knew that if they chose a *different* band for Australia, they'd in effect be requiring that special models would have to be made just for this market — which would virtually guarantee that Australians would have to pay more for the privilege of using the band. So the logical decision, once they'd decided to allow operation in the 420 - 450MHz region, was to allocate the same tiny band used in Europe.

Now as it happens, it was in this precise segment of the 30MHz-wide overall band that the amateurs had already set up many of their FM repeater channels. So the decision was inevitably going to be bad news for the amateurs; but as you can see it was basically just bad luck. Presumably the ACA had weighed this against the disadvantages of choosing a non-standard band for LIPD transceiver use (which would inevitably effect a much larger group of people), and made their decision accordingly.

In any case with the LIPD transceivers having a maximum EIRP of only 25mW, the risk of serious interference with even amateur repeaters wasn't likely to be very significant. The ACA presumably did take this into account, and subsequent experience seem to have suggested they were quite right: I gather from Mr Bray that there have been only 10 actual 'interference events' reported to date, even though the amateurs have been especially vigilant in their monitoring.

So overall, it isn't too hard to understand how the ACA came to allocate the 433.05 - 434.79MHz band for use by LIPD devices. Looked at objectively it made a fair bit of sense; it was just unfortunate that these were the very frequencies already in use by amateurs for some of their repeaters.

After all, as Mr Bray pointed out, the amateurs have always been one of the 'secondary' users of this band, and as such they've had to accept a certain level of interference all along. In any case since they have access to a huge 30MHz-wide band in this part of the spectrum, they always have the option of moving some of their repeater channels if they wish to reduce this interference — an option available to very few other spectrum users, and especially not to users of LIPDs.

Is it unreasonable to expect the amateurs to move their repeater frequencies, though, in situations like this where interference might occur? Frankly, I doubt it.

After all, radio amateurs continue to enjoy the luxury of access to almost 10% of the total electromagnetic spectrum, and one of the usual justifications for this is that they perform worthwhile experimentation on propagation and other technical aspects of radio communications.

One would have thought that as technical experimenters rather than mere 'exchangers of messages' via radio, amateurs might even welcome the occasional need to shift repeater channels in order to minimise interference. That in fact they'd see it as an opportunity for more interesting experimentation, rather than a cause for complaint...

Become unlicensed?

Before we leave the subject of LIPD transceivers, there was one other question that I took the opportunity to ask Mr Bray. This was regarding the aspect raised last month by correspondent Peter Mill VK3APO, who wrote that:

Your comment that they are legal would depend on the area of operation. As soon as the owner causes interference they are not covered by the Class Licence and could be considered to be illegal... ...The Companies that have decided to sell the devices that cover the complete LIPD allocation run the risk of supplying their customer with equipment that can become unlicensed.

Although this sounded pretty unlikely, it was an interesting point. So I put it to Mr Bray — could LIPDs in general, and the transceivers in particular, suddenly 'become unlicensed' in the event of any interference with another radiocommunications device?

Luckily he was able to clarify the point very quickly. And the bottom line is that the class licence which applies to LIPDs is essentially an authorisation for any person to operate a transmitter in the bands concerned, as long as it conforms to the various EIRP and other requirements. So the class licence doesn't cover the equipment itself, but the *act of using it*; as a result there's no way that LIPDs sold to somebody could suddenly become unlicensed and 'illegal', in the event of accidental interference.

Bearing in mind that one of the conditions of the LIPD Class Licence is that the transmitter concerned 'must not cause interference to the operation of another radiocommunications device', though, what *does* happen if and when interference occurs?

Well, as I understand Mr Bray, the situation really isn't much different from the one where a radio amateur's transmissions interfere with the radio or TV reception of their neighbours. They don't lose their licence, nor do the Federal Police suddenly arrive to confiscate their equipment. Instead commonsense rules, and there's the expectation that both sides will exercise goodwill and cooperate to achieve an amicable solution.

So there's no sense in which firms selling LIPD transceivers to consumers can be accused of misleading them, or tricking people into buying gear which can suddenly become 'unlicensed'. Sorry Mr Mill, but it isn't the transceiver that is covered by the class licence anyway; it's merely the use of it. As long as the firms sell transceivers with technical specifications meeting the requirements of the LIPD class licence, and don't mislead anybody to the contrary, they're acting entirely within the law.

My thanks to Mr Len Bray of the ACA for his help in preparing this month's column, by clarifying some of the issues regarding LIPDs. If you've found it interesting, I hope you'll join me here again next month. **ea**

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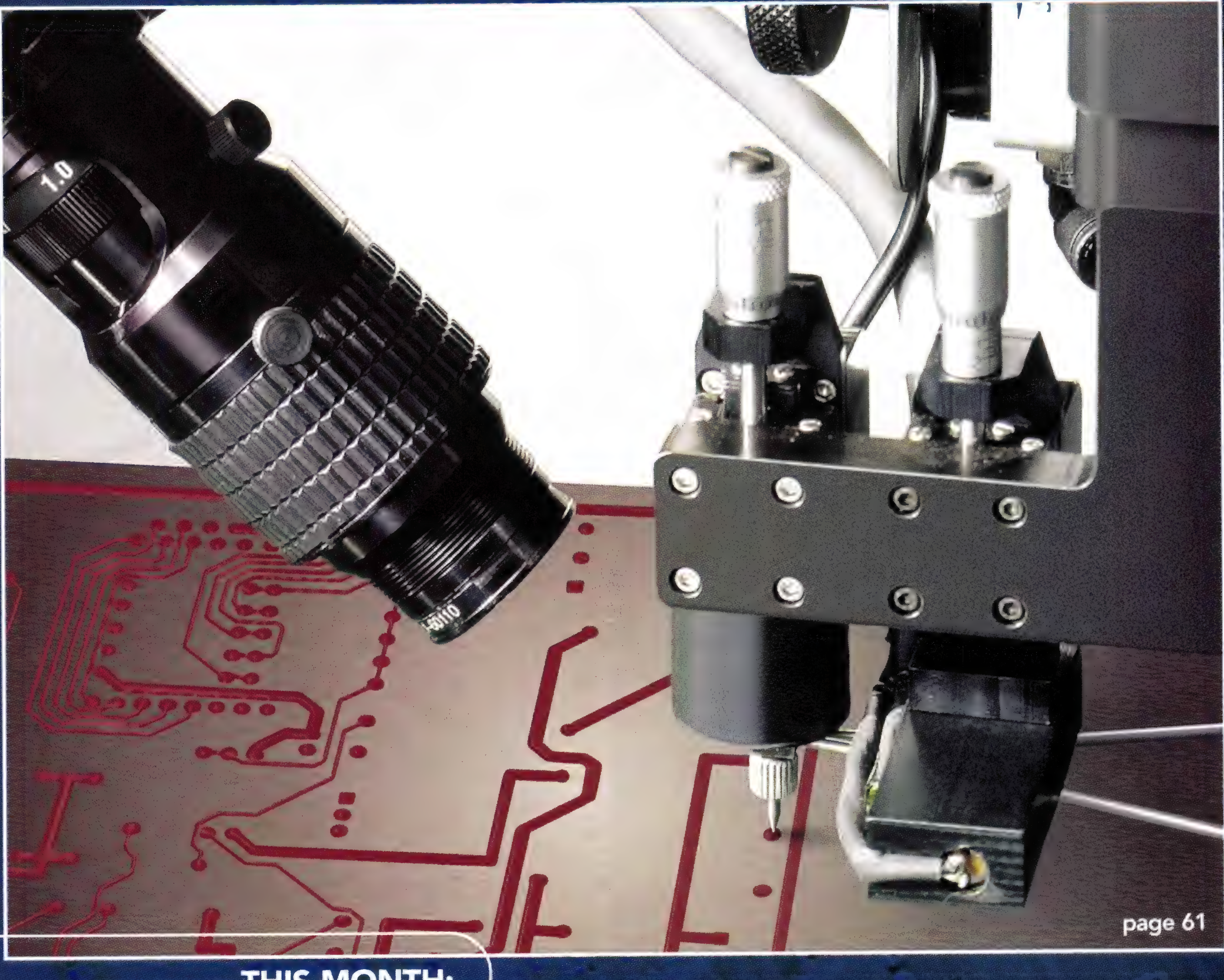
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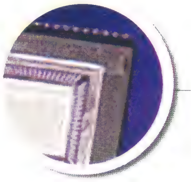


IN BRIEF

- IBM has announced a strategic alliance with chipmaker Xilinx in which IBM will co-develop, manufacture and market programmable logic chips with Xilinx for use in telecommunication and computer networking equipment.

The ICs will be based on IBM's PowerPC processors and use performance-boosting copper interconnect wiring. The components can be programmed with software to add new features or improve performance, saving time and money for customers designing new equipment.

The Semiconductor Industry Association predicts that sales of programmable logic chips, used by companies such as Cisco Systems and Lucent Technologies, will rise 41% this year to US$4.1 billion and reach $9.7 billion by 2003.

- The Iridium consortium of communications satellites has won yet another stay of execution, as Motorola for the third time in six months agreed not to send the 63 satellites on a crash-and-burn trajectory.

This time, Iridium was given until August 9 to pursue a potential bailout by Castle Harlan, a New York investment bank. Weeks earlier the latter withdraw a US$50 million plan to buy Iridium's assets, but the two parties were reportedly still talking.

If no agreement is reached, Motorola has court clearance to destroy the US$6 billion network which failed to attract customers to carry around the US$3000, bulky Iridium wireless telephones and pay up to $9 per minute for 'anywhere' wireless phone access.

Compaq chosen for supercomputer project

THE US NATIONAL Science Foundation has selected Compaq Computer to help build a new supercomputer capable of processing 6 trillion operations per second. Compaq will design the US$36 million computer in cooperation with the Pittsburgh Supercomputing Center. The machine will be based on Compaq's AlphaServer SC and contain up to 2,728 Alpha processor chips.

The computer will be used by the NSF for research in the development of new drugs, weather forecasting and modelling of earthquakes.

The Compaq machine will not be the world's fastest supercomputer. That one has already been built by IBM for the US Energy Department's Lawrence Livermore National Laboratory.

That machine, known as the Advanced Strategic Computing Initiative White (ASCI-White), covers two basketball courts and weighs 106 tons. It is capable of performing 12.3 trillion operations per second.

IBM builds functional 5-atom quantum computer

IBM HAS ANNOUNCED that its researchers have built the world's first prototype computer based on quantum mechanics. The system uses five atoms to work as its processor and memory.

Researchers were able to use the 'system' to solve a typical mathematical problem used in cryptography — finding the period of a function. Unlike conventional systems that would require multiple cycles to resolve the simple problem, the quantum machine accomplished the task almost instantly in one step.

Isaac Chuang, the IBM researcher who led the team of scientists from IBM, Stanford University and the University of Calgary in developing the quantum mechanics computer, said the experiment showed the viability of the quantum computer. "I think this experiment shows we are on a pathway which is predictable and understandable, that quantum computers will be useful someday."

Unlike regular transistors which have an 'on' and 'off' state, the quantum based transistor has a third state that can be described as 'both' or 'neither.' The state of the quantum transistor is dependent on the spin of an electron. When the spin of a particle is up, the atom can be read as a one, and the spin down can be read as a zero.

In the quantum computer the quantum particles can also be in a state of 'superposition' — spinning simultaneously up and down. This state would represent both zero and one and everything in between. Instead of solving the problem by adding all the numbers in order, a quantum computer would add all the numbers at the same time.

This phenomenon permits a quantum computer to have enormous power. For certain types of calculations, like complex algorithms for cryptography or searches — a quantum computer using several hundred more atoms in tandem would be able to perform billions of calculations at the same time.

Chuang said the next phase will be to build a machine with 7-10 atoms working in tandem. This should be achieved within the next two years, but the first commercial versions of the machine won't be available for another 15-20 years.

"A quantum computer could eventually be used for practical purposes such as database searches — for example searching the Web could be sped up a great deal — but probably not for more mundane tasks such as word processing", Chuang said.

Intel enters 'Pocket PC Camera' market

INTEL IS NOW SELLING the 'Intel Pocket PC Camera', a compact digital still and video camera that will allow consumers to take Internet-ready photos and short video clips and post them on a web site or send them as e-mail attachments.

The battery-operated camera retails for US$149. It has 8MB of flash memory, and is capable of taking 128 pictures or two minutes of video in a 640 x 480 pixel mode. While much lower in resolution than regular digital cameras with around 1028 x 960 pixels, the images are ideal for transmission over the bandwidth-sensitive Internet where most consumers are using 33k and 56k modems. It weighs eight ounces with four AAA batteries and can be shoved into most pockets.

The Intel Pocket PC Camera includes software that allows for downloading images to a computer and let users tinker with them to adjust their quality or crop images before e-mailing them or posting them to personal Web pages.

"The great thing about this camera is it's really focused on people who want to share their life's story over the Internet", said Dwayne Canfield, product line manager at Intel's Connect Products Division in Hillsboro, Oregon. "You can have it hooked up to your computer or you can disconnect the cord and take it with you."

Intel formed the Connect Products Division with the mission of producing Intel-brand consumer products. The group's first product was launched late last year — a countertop device that allows access to e-mail, an organizer and the Internet. **ea**

SOLID STATE

UPDATE

Field-programmable analog IC

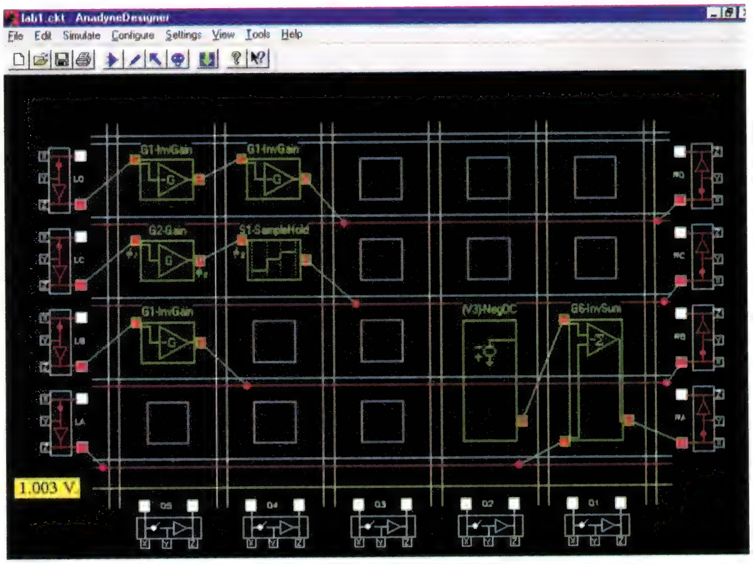
ANADYNE MICROELECTRONICS has just launched a radical new approach to analog circuit design, based on a field-programmable analog array (FPAA). The company's technology - spun out of Motorola after several years of R&D - brings FPGA-style benefits to the analog arena for the first time.

FPAA technology allows electronics designers to slash time-to-market and nonrecurrent engineering costs thanks to a CAD tool with drag-and-drop analog functions. It also boosts product flexibility greatly by allowing PCBs to be programmed with application-specific circuits during assembly, or on-the-fly in the field. Moreover, its benefits are equally applicable for high or low volume projects - even down to one-off designs.

Anadyne's innovative technology delivers a major breakthrough in analog design by allowing complete analog signal conditioning and processing systems to be integrated inside a single off-the-shelf IC. It adds a completely new electronics component segment alongside discrete linear ICs, and semi- or full-custom analog ASICs.

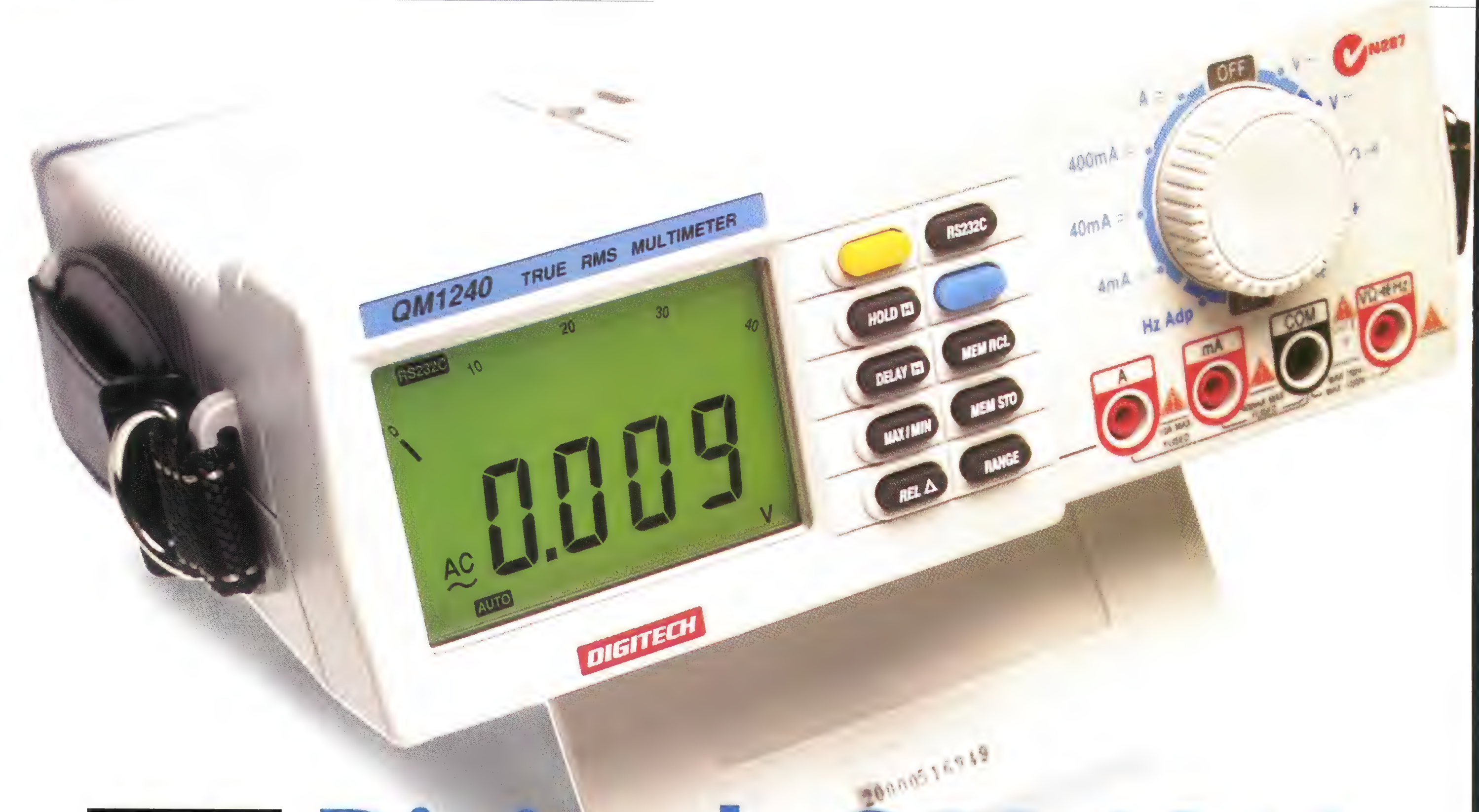
The company's first product — the AN 10E40 — provides a matrix of 20 configurable analog blocks consisting of switched-capacitor op-amp cells, surrounded by a programmable interconnect and I/O structure. Common analog signal conditioning functions such as offset removal, rectifiers, gain stages, comparators and first-order filters can be implemented using just one cell. More complex functions such as high-order filters, oscillators, pulse-width modulators and equalizers can be implemented using two or more cells.

With 20 cells available, the AN 10E40's resources may be combined to create highly complex analog systems offering, for example, signal conditioning for multiple channels, and/or signal processing functions such as full PID control. The circuit's configuration is held in on-chip SRAM, which is initialized on power-up from EPROM, or through the chip's microprocessor peripheral interface.



An accompanying free CAD tool - AnadyneDesigner - with its analog function library, holds a key to the versatility of the new component, as it allows inexperienced users to build systems without needing to know the underlying circuit techniques.

Unlike conventional analog design, no circuit knowledge, skills with analog simulators, or maths abilities to work out the transfer functions are required. Moreover, no bread-boarding is needed to build a trial circuit. Instead, users can simply select analog building blocks which are specified purely in terms of their functions, and enter the particular characteristics they need. In the case of a biquad filter for example, all a user specifies is cut-off frequency, pass band gain, and Q factor. For more information, visit **www.anadyne-micro.com**. **ea**



Digitech QM-1240

3-3/4 digit benchtop DMM

A welcome addition to the selection of portable/benchtop DMMs now available is the Digitech QM-1240 from Jaycar. It offers a full set of measurement ranges, dual digital and analog readouts and a built-in serial interface for interfacing to a Windows 95/98 PC — all for a very competitive price. **by Jim Rowe**

SUMMARY

- A solidly made 3-3/4 digit bench type DMM, with built-in serial interface.

PROS

- All normally needed ranges
- Good resolution and accuracy
- Flexible in terms of power supply

CON

- A bit sensitive to hum pickup
- PC software poorly documented, and a tad flaky

RRP

- $299

AVAILABLE

Jaycar Electronics, 8-10 Leeds Street, Rhodes 2138. Phone 1800 022 888, or email to techstore **jaycar.com.au.**

COMPACT HANDHELD multimeters are great for checking and troubleshooting 'out in the field', but they're often a bit of a nuisance back on the workbench. They're usually quite small and light, and therefore easily knocked or pulled off the benchtop. In addition they're frequently hard to tilt up at a convenient viewing angle (or unstable if you try), and their batteries somehow always choose to go flat at the most inconvenient time...

For this sort of work, a traditional 'system' or benchtop DMM is usually far more appealing. It's generally bigger and more sturdy, can be tilted up in a stable way or placed on a shelf for convenient viewing, and can usually be operated from 240V AC as well as batteries. In addition, this type of DMM usually offers more measurement ranges than the average portable, and often greater resolution and accuracy to boot. So for a variety of reasons, it's generally a far better choice for anyone who does a lot of bench work.

Sad to say, though, there's far fewer of these models to choose from than with the handhelds and those that are available are often quite pricey. So the new Digitech QM-1240 should be of particular interest, because it offers quite an impressive range of features at a competitive price.

The QM-1240 is big and sturdy enough for bench use — 238 x 230 x 83mm, with a weight of about 1.5kg — yet still compact and portable enough for mobile and field work. It's housed in a shock-resistant case of ABS plastic, which has an inbuilt tilting bail as well as a storage compartment for test leads. The case also has further compartments for access to the batteries and protective fuses, and comes with its own carrying handle and shoulder strap as well.

In terms of measurement safety the QM-1240 has a 'Category II' rating (1000V DC or 750V AC RMS) and meets the IEC 1010-1 1000V specification when earthed via the three-wire mains cord. It has fully recessed and shrouded input jacks.

A true-RMS measuring instrument, the QM-1240 provides 3-3/4 digit (4000 count) resolution on most ranges. Readout is via a 67 x 46mm high contrast LCD panel with backlighting, which has easy to read 18mm high digits plus an equally readable analog bargraph (42 segment) display at the top. Needless to say there's also a healthy complement of icons for ranges and status indication.

To the right of the LCD panel and in the centre of the front panel there's a set of 10 pushbuttons, used for selecting various functions such as backlighting on/off, measurement hold on/off, maximum/minimum reading, relative measurement mode and manual range changing. Further to the right again there's the main rotary switch, which is used for power on/off and measurement mode/range selection.

By the way the QM-1240 has a built-in optically isolated RS-232C serial port and can be safely hooked up to a PC to pass measurement data for logging, etc. In fact it comes complete with a serial data cable for the purpose, plus a couple of floppy discs with *View 1.1*, a data capture program which runs under Windows 95/98. The RS-232C communications mode is enabled/disabled by another of the 10 function pushbuttons.

As well as the usual volts AC and DC, and DC and true-RMS AC current ranges, the QM-1240 provides for resistance and continuity measurement, diode testing, capacitance and frequency measurement. There's also a rather poorly explained 'adaptive/ADP' range, which seems to effectively measure 0 - 400mV DC by converting the input voltage to frequency.

Digital measurements are updated twice per second, except in the case of capacitance which is only once per second; the analog bargraph display is updated 20 times per second.

There are five DC voltage ranges, spanning from 0 - 400mV at the bottom end to 0 - 1000V at the top. Rated accuracy on these ranges is +/-(0.3% + 2 digits) on the four upper ranges, with the bobble component increasing to +/-5 digits on the lowest range.

For AC voltage there are four ranges, spanning from 0 - 4V up to 0 - 750V with a rated accuracy of +/-(0.8% + 5 digits) from 50 - 60Hz, or +/-(1.2% + 5 digits) from 45Hz to 1kHz.

There are four current ranges for both DC and AC, spanning from 0 - 4mA up to 0 - 10A (20A for less than 30 seconds). The rated accuracy for DC is +/-(0.8% + 5 digits) for the three lower ranges and +/-(1.5% + 10d) for the highest range, while the corresponding figures for AC (45 - 400Hz) are +/-(1.5% + 5d) and +/-(2% + 10d). The burden voltage in each case is 600mV maximum for the three lower ranges and 900mV maximum for the highest range.

There are six resistance ranges, with fullscale readings spanning from 400 ohms up to 40M. Rated accuracy for the lowest range is +/-(0.5% + 5d), improving to +/-(0.5% + 3d) for the three next ranges before reducing to +/-(1% + 5d) and +/-(1.5% + 10d) on the two top ranges. The open-circuit voltage for all resistance ranges is 450mV, making the meter suitable for in-situ measurements in silicon circuitry.

For capacitance measurements there's a total of five ranges, with full scale readings spanning from 4nF to 40uF. Rated accuracy for most of the ranges is +/-(2% + 5d), broadenind a little at each end.

Finally there are five frequency measurement ranges, spanning from 0 - 99.99Hz up to 0 - 600.0kHz, and all with an accuracy of +/-(0.1% + 4d).

Trying it out

I was able to run a fairly comprehensive series of tests on the sample meter, comparing its performance with a reference Yokogawa 7562 lab meter for most of the ranges, and otherwise checking it against reference resistors and capacitors previously calibrated with instruments such as the HP 4263A precision LCR meter. For the frequency ranges I used signals from the PC-driven Arbitrary/Function Generator (i.e., synthesised from a crystal reference), and also from the TV-Derived Frequency Reference (with roughly Rubidium accuracy).

In these tests the QM-1240 gave a very good account of itself too, with readings that were well within the rated accuracy figures in all cases. The basic DC voltage accuracy was below 0.05% for most ranges, and the largest error I could measure on the lowest range was -0.13% — well within the specs.

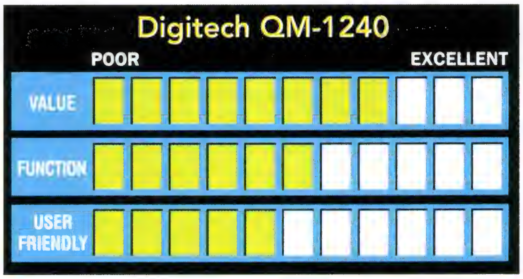
Most of the other modes and ranges gave similar results. The largest error I could get on the AC current ranges was +0.76% on the 10A range, for example, while on the resistance ranges it was +0.37% and on the frequency ranges -0.05%. These figures are all inclusive of bobble, by the way.

I did find the meter a bit sensitive to the proximity of the operator's hand near the front panel, though, suggesting that it might benefit from improved shielding in this area. I suspect the internal integration time is set to minimise sensitivity to 60Hz hum too, instead of 50Hz (which would be more appropriate here). But otherwise, the basic performance of the meter itself was very hard to fault. A look inside the case confirmed that it seems to be quite well made, and should therefore be very suitable as a sturdy workbench instrument.

I wasn't so impressed with the accompanying PC software, though. This had no documentation apart from a very cryptic readme file on one of the floppy discs, and when I took a punt and tried installing it on my Pentium II system running Windows NT4 (on the basis that most Win 95/98 software will also run on NT4), it not only *wouldn't* install properly but clobbered my dialup networking as well. Grrrr!

The software probably needs some work, then, before the QM-1240 would really be much use for PC-based data logging. Quite apart from that, it would also be good if the software had proper documentation and was compatible with DOS and Win 3.1 as well.

Mind you, even without the software the meter still represents pretty good value for money. Most similarly rated bench DMMs are significantly more expensive than the quoted $299. There's no problem with the optically isolated RS-232C interface, either, so the meter should be quite capable of talking to a PC when provided with the right software. **ea**



Digitech QM-1240

	POOR										EXCELLENT
VALUE	🟨	🟨	🟨	🟨	🟨	🟨	🟨	🟨	☐	☐	☐
FUNCTION	🟨	🟨	🟨	🟨	🟨	🟨	☐	☐	☐	☐	☐
USER FRIENDLY	🟨	🟨	🟨	🟨	🟨	☐	☐	☐	☐	☐	☐

Linear **actuators**

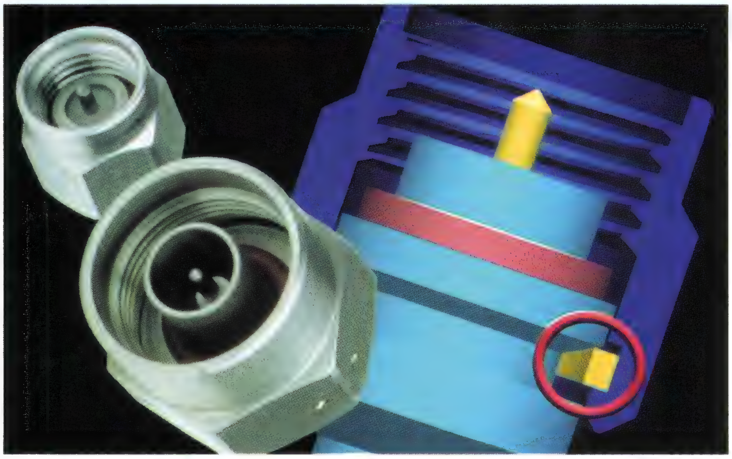
Kimco Magnetics has introduced two new actuator models in its LA15-16 line. The new model LA15-16-020A is a two-wire non-commutated direct drive linear voice coil servo actuator, featuring cog-free, hysteresis free motion with high acceleration capability.

The 38mm diameter x 40mm long device has a 10mm stroke. It is rated at 1.2kg force continuous, (3.4kg force for 10 seconds) and is a cost effective alternative to rotary-to-linear conversion servo drives.

The LA15-16-024A model is a 64mm stroke linear voice coil actuator rated at 2.5kg force, continuous, and 9kg force for 10 seconds. This two wire non-commutated actuator measuring 38mm diameter by 40mm long is hysteresis free, cog-free and has a simple linear control characteristic. It is a cost-effective high performance direct drive servo mechanism that exceeds the capabilities of rotary-to-linear conversion devices.

■ *For more information, contact BB Sensors & Systems, sales@beikimco.com; Website www.beikimco.com.*

Strong C-clip microwave connectors



Kaman Instrumentation's high performance microwave cable assemblies now feature connectors with a tensile strength in excess of 110kg, depending on the connector and cable size.

The connectors feature a captured C-clip design that substantially increases the tensile strength of the connectors by using the same principal as a keystone in an arch. The Keystone C-clip connectors offer high reliability for such critical applications as space, electronic warfare, and high-energy physics.

Traditionally, the connector is the most critical area in any cable assembly, and the C-clip has been a weak point in microwave connectors. However, the more tensile stress that is applied to the body of the Keystone connector, the more firmly the C-clip holds the connector together by squeezing more tightly into its holding groove.

The C-clip now comes standard with Kaman's flexible microwave coaxial cable or with their high-performance SiO cable assemblies. Kaman's SiO cable is superior in phase stability over temperature and inherently rad-hard. It is available with stainless steel or ultra-lightweight titanium jacketing. Kaman recently introduced Kaman Flex, a breakthrough product in flexible cable assemblies.

Cable assemblies with the Keystone C-clip connectors are available now directly from Kaman. Quotes are available upon request.

■ *Further information regarding Kaman's products and services are available on the web at www.stablecable.com.*

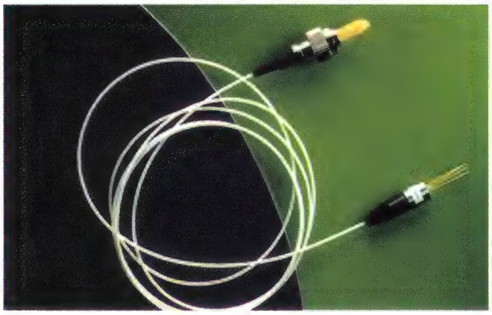
Laser diode modules

Lumex has announced the introduction of two new1310nm laser diode modules that qualify with Bellcore TA-NWT-000983 requirements. These modules are designed for a wide range of communication applications, including short and medium range optical data links, optical LANs and subscriber loops.

The modules feature rugged, hermetically-sealed TO-18 packaging, and can operate at high ambient temperatures without requiring a TE cooler. They feature a InAlGaAs/InP die composition, include a built-in monitor photodiode, and are available in versions with either a flat window or a ball lens cap to match the optical fibre to which they will be attached.

Electro-optical specifications include a maximum optical power output of 10mW at 25°C, with a minimum optical power output of 5mW across the entire -40° to +85°C operating and storage temperature range. Optical output is centred at 1310nm, with a very narrow spectral width of just 1280 —1340nm. Other ratings include an LD reverse voltage of 2V, a PD reverse voltage of 15V, and a PD forward current of 1.0mA.

■ *For more information on Lumex's new 1310nm laser diode modules, or for samples, contact Lumex via email at sales@lumex.com, or on the web at www.lumex.com*



GPIB for your USB

Engineers and scientists who want to connect their GPIB instruments to a standard PC through the USB port now can receive higher transfer rates and compatibility with the latest Microsoft operating systems.

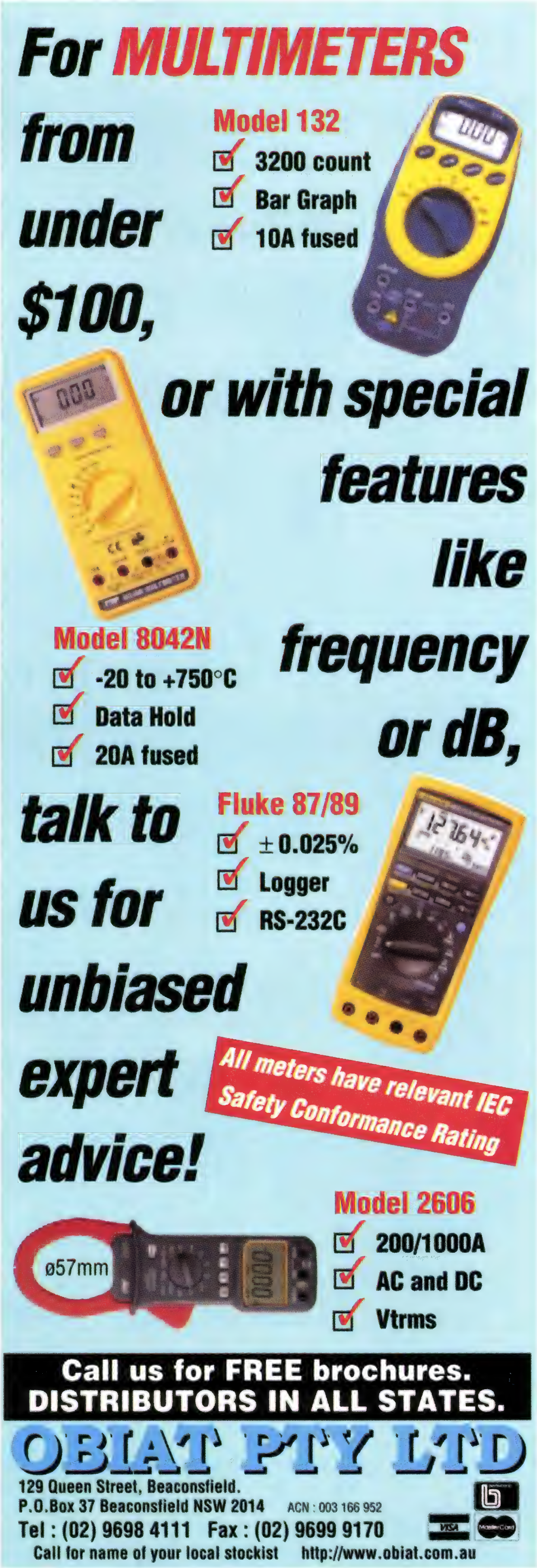
National Instruments GPIB-USB-A is the next generation GPIB-USB instrument controller that offers transfer rates of more than 650KB/s and works with Windows 2000/98 systems.

The GPIB-USB-A transforms any Windows 2000/98 computer with a USB port into a full-function IEEE 488.2 controller that can control up to 14 programmable GPIB instruments. The small, lightweight GPIB-USB-A is ideal for portable applications using a laptop computer or applications using computers with no available internal interface slots.

The GPIB-USB-A is easy to install and use. The controller has a preattached USB cable on one end and a GPIB controller on the other, which attaches directly to the instrument. When the GPIB-USB-A is connected to the USB port of the computer, the operating system automatically recognises and configures it. To make life even easier, it has no switches and requires no external power cord.

National Instruments packages the GPIB-USB-A with NI-488.2 driver software, the de facto industry standard software architecture for GPIB instrument control, and NI-VISA driver software, a comprehensive package for configuring, programming and troubleshooting instrumentation systems comprised of VXI, VME, PXI, GPIB, and/or serial interfaces. NI-488.2 and NI-VISA are tightly integrated with National Instruments Measurement Studio and LabVIEW software development tools. Any program previously written for other National Instruments GPIB interfaces runs unmodified with the GPIB-USB-A.

■ *For more information contact National Instruments Australia, P.O. Box 466, Ringwood 3134, or email: info.australia@ni.com.*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☑ Bar Graph
☑ 10A fused

Model 8042N
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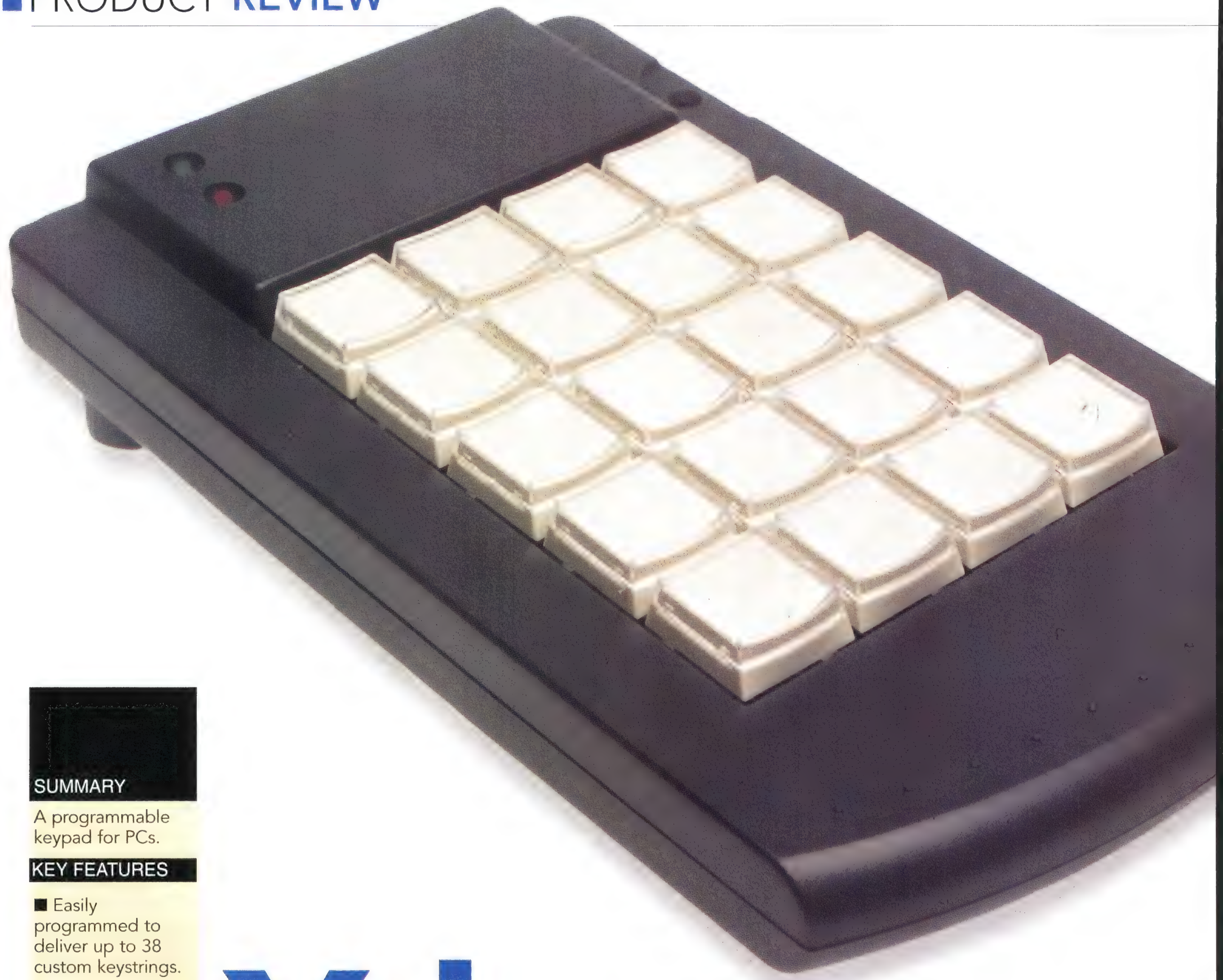


X-keys:

a little desktop wonder

Ever wished your computer keyboard had just a *few* more keys, which could be programmed easily to save you having to type in often-needed character strings? Wish no longer, because this is exactly what you get with the X-keys Desktop.

by Jim Rowe

SUMMARY

A programmable keypad for PCs.

KEY FEATURES

- Easily programmed to deliver up to 38 custom keystrings.
- Keytops are easily customised with your labels.
- Powered by the PC, just connects into keyboard cable.
- Can be used as a custom 'stand alone' keyboard.

RRP

- $251 including GST.

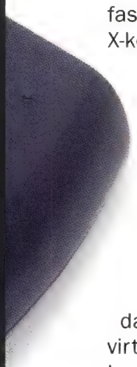
AVAILABLE

Microgram Computers, Unit 1/14 Bon Mace Close, Berkeley Vale 2261. Phone (02) 4389 8444, fax (02) 4389 8388, or order via the website at **www.mgram.com.au**.

GRAPHICAL USER INTERFACES and macro facilities have made our computers and software a lot more user friendly than they used to be, that's true. But I still find myself having to type in strings of characters from the keyboard, with monotonous regularity — and I'm sure I'm not alone. Whether it's passwords or just function key sequences for older programs, there's still an irritating need to keep typing 'em in.

Like me, you've probably found yourself wishing the keyboard had a few extra keys that could be programmed easily to supply these often-needed strings. But that's about as far as it's gone. I've been vaguely aware of custom software that reprograms the normal F1-F12 keys along these lines, but frankly I've been put off by the possibility that this software might clash with some of my main applications, and cause more problems than it solves.

What was needed, I thought, was a completely separate 'hardware' solution, that could be added to the computer in a totally transparent and no-hassle fashion. And that's exactly what the designers of the X-keys Desktop have done.



As you can see from the photo, it's a compact self-contained keypad which provides 20 keys in a 4x5 array, and can be placed anywhere you want it on the desktop. Like your main keyboard it's powered from the PC, and comes complete with an adapter cable so the two are simply 'daisy chained' together, from the normal keyboard socket (which can be of either the 5-pin DIN or smaller PS/2 type).

When it's hooked up in this way, with a standard keyboard there as well, the X-keys Desktop is virtually invisible to the computer as a separate entity. Once programmed, it simply sends a string of character codes to the PC whenever you press one of its keys, just as if the codes had come from you typing on the main keyboard. There's no TSRs or special driver software, and hence no problem with hardware or software compatibility...

(On the other hand once it *is* programmed, the keypad can actually be connected to the PC alone, and will pretend to be a normal keyboard. The PC will boot up normally, etc — so you can use the X-keys Desktop as a special custom keyboard, for PCs that will be used in dedicated applications.)

Programming

How easy is it to program? Much easier than I expected. With it hooked into the keyboard cable and the PC booted up normally, all you do is switch the X-keys Desktop into its programming mode (using a small switch on the upper right), and then press whichever of its keys you want to program. Then it's simply a matter of typing in the character string you want it to memorise for that key, using the main keyboard. You simply press the same keypad key again, to indicate the end of that string.

You repeat this operation for each of the keys you want to program, and you can either do them all in the one programming session, or in small groups or even individually if you wish. In each case flicking the control switch back to 'operate' mode ends the programming, and the programmed keys are immediately capable of generating the strings you've programmed.

Needless to say you can also change the programming of any key at any later time, simply by repeating the procedure for that key alone. It's very straightforward and user friendly.

How long can the individual strings be? Apparently each key is allocated three characters to start with, but there's a further pool of 480 characters available for any extras that individual keys may need. So there's room in the keypad's EEPROM memory for an average of about 27 characters per key, with individual keys able to store more than this if others don't need that many. This should be more than enough memory capacity for just about any likely application.

By the way you're not just limited to a total of 20 keys and strings. In fact the design is quite flexible. Any one of the keys can be programmed as a 'layer toggle' key (i.e., a dedicated shift key), and this can then be used to select a second layer of coding for programming all the others. So in reality, you can have a total of 38 stored keystrings.

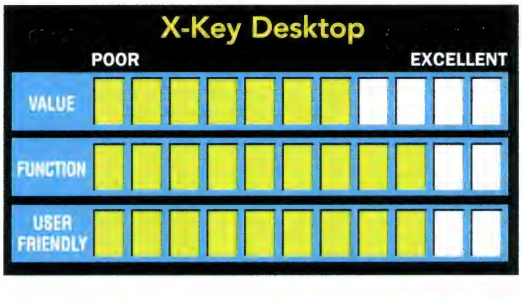
As if that wasn't enough, you can also couple two adjacent keys together, with either a horizontal or vertical 'double keytop', to turn them into larger single keys — for more important function strings, etc. This obviously lowers the total number of different strings that can be stored, but is good for producing custom keypads.

Talking about keytops, all of those on the X-keys Desktop are of clear plastic and easily removed using a special 'puller' tool (supplied), so you can fit them with small squares of card showing your programmed function labels. A sheet of blank squares is actually supplied, to get you started. Once each new custom label is fitted, its keytop is simply pressed on again to protect it from wear and finger grease.

There are still more features of the X-keys Desktop, too. For example individual keys can be programmed to automatically repeat (i.e., have the 'typematic' function) when held down; they can also be programmed to generate separate strings when pressed and then when released. You can also program short pauses into the keystrings, program them to be sent more slowly, have the keypad remember Caps Lock settings and so on. It's quite flexible.

And how does it all work in practice? Very nicely indeed. I tried hooking the sample unit up to a couple of different PCs, and in each case was able to program and use it very easily. I tried programming and re-programming the keys, with short and long strings — including one string of 68 characters. There were no hassles at all, and my impression is that the X-keys Desktop has been very carefully designed. It's a little desktop wonder, in fact.

So if you'd like to be freed from the chore of repeatedly having to key in passwords and control strings, and perhaps also lower the risk of getting RSI, the X-keys Desktop is well worth considering. **ea**



Tough Stoneface sensors

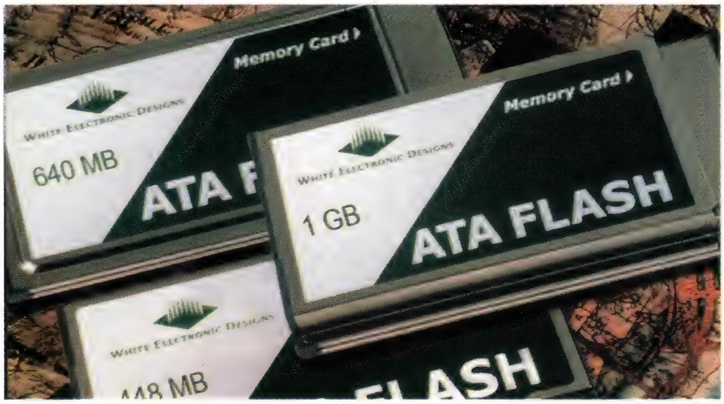
Turck's new Stoneface inductive proximity sensors provide durability similar to stainless steel face sensors at standard sensor prices. The new sensors offer exceptional weld-field immunity and are ideal for applications in the automotive assembly, body and power train industries where abrasion is a factor.

Stoneface sensors, available in embeddable and non-embeddable models, feature a front face made of a thermoset plastic specifically developed for resistance to weld slag, scratching, pitting and abrasion. Users select from un-plated brass, stainless steel or Teflon-coated barrels.

Stoneface sensors are available in Uprox and ferrite-core styles. Both styles are available in embeddable and non-embeddable models and feature short circuit, overload, wire-break and reverse polarity protection.

■ *For more information on these rugged sensors, contact Micromax Pty Ltd, on 1300 362 626.*

New ATA Flash Cards go to1GB



White Electronic Designs has just introduced a new family of high capacity ATA Flash PCMCIA cards offering memory storage from 32MB to 1GB — the highest capacity ATA card currently available in the industry.

These ATA25 Series cards offer high-speed data transfer rates including sustained write up to 3MB/sec, approximately five times faster than other standard ATA products, and provide low power operation, consuming typically 25mA in active mode and 0.3mA in standby mode. Additionally, the cards support a wide, universal voltage range from 3.3V to 5V. This feature allows full interoperability and exchangeability between 5V and 3.3V systems.

Memory cards are gaining tremendous popularity in mobile computing and embedded applications and the technology is expected to migrate to 3.3V over the next few years. In the meantime, these universal cards support both voltages and are intended for use in a wide variety of systems both old and new.

White's ATA25 Flash cards are removable storage media that emulate hard disk operation and are intended for use in systems requiring higher levels of data integrity. PCMCIA cards are made with 100% 'silicon memory', and are built as non-mechanical. They operate with low power, are fast and reliable, and are inherently resistant to shock and vibration. Consequently these cards are ideal for applications in the avionics, mobile computing, and transportation industries.

■ *For additional information, contact White Electronic Designs, email: info@whiteedc.com. or via their website at www.whiteedc.com.*

Little **loggers**

The Hioki 363X data loggers can be mounted in outdoor or indoor situations, being small, battery operated and capable of operation in ambient environments from -20 to +70°C, An extensive range of sensors and connection cables allow the data loggers to be used flexibly and in hostile environments.

The 363X can store a total of 16000 data points, while the 3631 temperature plus humidity logger, being a two channel instrument, stores 8000 max RH and temperature readings, providing therefore 333 days of records when sampling at 1 hour intervals.

Sampling time is adjustable from a minimum of two seconds to one hour per data point. Data is stored in non-volatile memory, so no data is lost if batteries are exhausted. Battery life is one year for the 3631, and two years for the other versions, while unique identification numbers identify individual loggers.

■ *For further information, contact: Nilsen Technologies, 150 Oxford Street, Collingwood Vic. 3066; Phone: 1800 623 350.* **ea**

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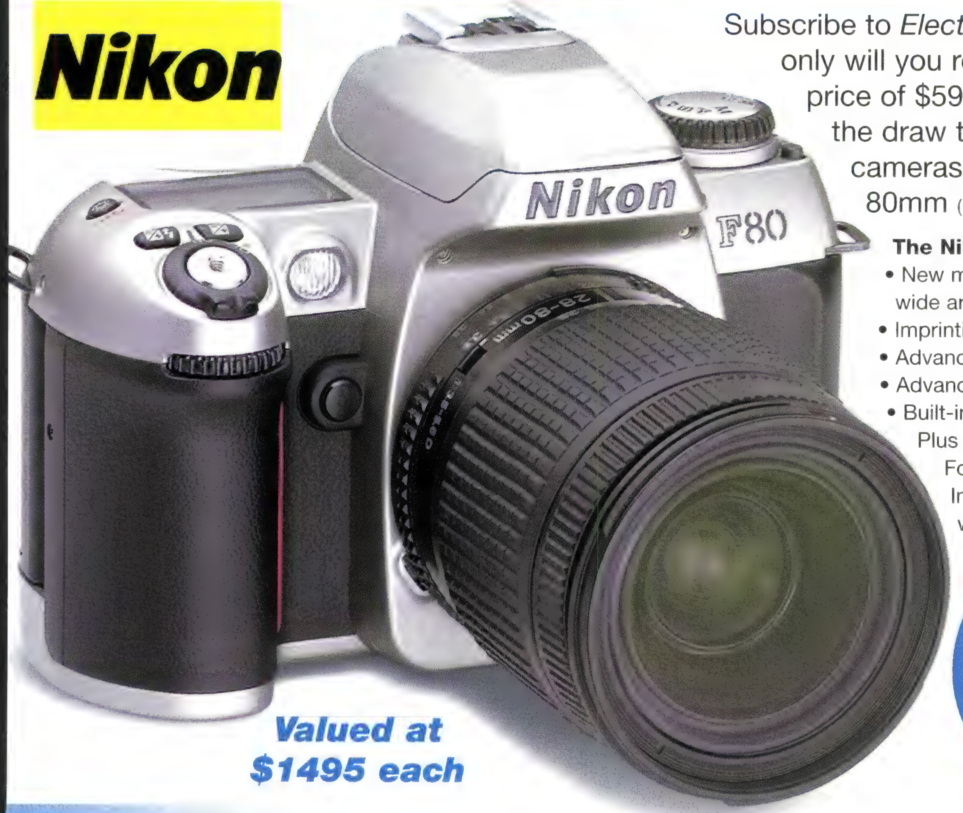

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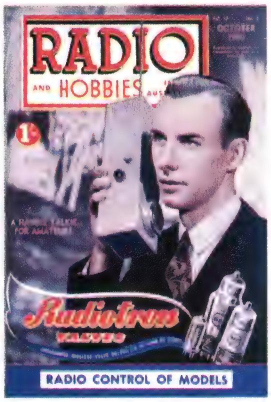
HISTORY & CROSSWORD

Published since 1922, **Electronics Australia** is one of the longest-running technical magazines in the world. Here are some interesting items from past issues:



50 YEARS AGO

Diamond stylii best for wear: Although diamond stylii are by no means new, having been used in specialised pickups for many years, it seems likely that they may gradually be adopted for domestic pickups. In durability and hardness they have a very great advantage even over the popular sapphire.

Automatic diagnosis: A small news par in the daily press referred recently to a method under development whereby certain diseases could be diagnosed and treatment prescribed by electronic means.

The basic idea is that persons radiate waves which vary according to their state of health.

Amateur transmissions: One regrets to note that amateur operation, particularly on 7 and 14mc, is not always what it should be. Despite many cautions and encouragement to the contrary, much matter is transmitted from time to time which does not do credit to the station operators, some of whom have been in the game quite long enough to know better. The highly objectionable practice of breaking in on transmissions with facetious remarks, for instance, seems to have gained new life of late.

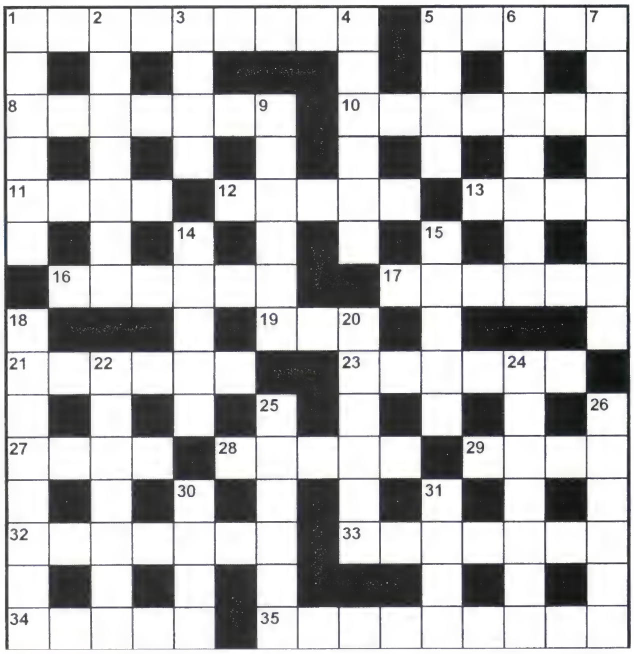
25 YEARS AGO

Advanced navigation system for US tuna boats: Advanced navigation systems that convert electronic bleeps from satellites into highly accurate position pinpointing are being introduced into the US tuna fleet this year aboard two San Diego-based seiners, the *Capt. Joe Medina* and the *Kerri M.*

The electronic navigation system, first developed for the US Navy, will provide *Medina* with his exact location at any given moment. In addition, the system will compute the exact course to be followed to any destination in the world, together with other needed data.

Hitachi develops large area LCD display: Hitachi Ltd, Dai Nippon Toryo Company Ltd, and Ashai Glass Company Ltd have pooled resources to produce a large-area liquid crystal display system. Measuring 0.4 x 0.5 metres, the new LCD display is the largest in the world, and is capable of displaying some 600 alphanumeric characters.

Microprocessors ready for market impact: The US electronics industry has made such significant advances in the miniaturisation of computer circuitry in recent years that it is now pushing for the introduction of computer controlled functions in such things as automobiles, gasoline pumps, traffic control signals and supermarket cash registers. **ea**



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1 Heating device. (9)
5 Larceny. (5)
8 Using a lathe. (7)
10 Mathematician notable for a transform. (7)
11 Objects with female threads. (4)
12 Installs data from tape or disk. (5)
13 Aerodynamic force. (4)
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17 Type of switch. (6)
19 Digital versatile disk. (1,1,1)
21 Power receptacle. (6)
23 Result of ghosting. (6)
27 Seek information on the Internet. (4)
28 Coats with gold. (5)
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35 Web browser. (9)

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2 Dane who discovered magnetic effect of current. (7)
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4 Group to which iodides belong. (6)
5 Recording medium. (4)
6 Eliminating data. (7)
7 Entertainment areas. (8)
9 Connect to earth. (6)
14 Product of acid-alcohol reaction. (5)
15 Said of orbit 90° to equator. (5)
18 Control lever. (8)
20 Devices giving unidirectional conduction. (6)
22 Said of ready-to-go projects. (7)
24 Item with ring and screw. (3,4)
25 Inventor of cloud chamber. (6)
26 Component that passes signals selectively. (6)
30 Supply power. (4)
31 Motion picture experts group. (4)

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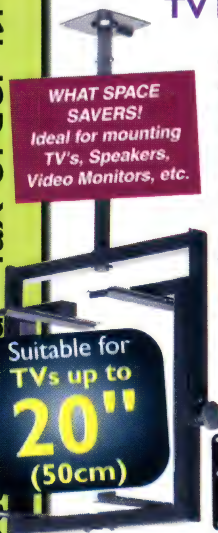

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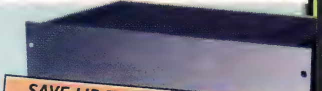

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H 5011	1U	44mm	Raw Aluminium	**$72**	**$55**
H 5012	2U	88mm	Raw Aluminium	**$81**	**$65**
H 5031	1U	44mm	Black Anodised	**$76**	**$59**
H 5032	2U	88mm	Black Anodised	**$92**	**$75**
H 5033	3U	132mm	Black Anodised	**$96**	**$79**

Mobile Phone & Video Camera Battery Charger

Sorry, Not available from dealers.

Accepts common video camera batteries, with the appropriate adaptor (see below). Suitable for Ni-Cd and Ni-MH cells. **Features:** • LED power meter for charge and battery status. • Discharge-then-Fast Charge function • Deep discharge mode for cycling batteries to remove memory effect. • Auto switches to trickle charge once charged. • Powered by 12V DC, and **includes car cigarette lighter adaptor and 240V plugpack** • Thermal overload protection • ***Supplied with AA charger adaptor plate***

A 0250 Battery Charger WAS $69.95, NOW **$30**

MASSIVE 60% OFF!!

Adaptors to Suit:
A 0255 Motorola 8000 / 9000 / 9800
A 0259 Nokia 2110 / 2120
A 0261 Nokia 101 / 121 / PT612
A 0263 Ericsson 237 / 337 / 338
A 0265 NEC P3 / P200 / P201 / P300 / P301
A 0267 Oki 900 / 910
A 0269 Sony/Sharp/Hitachi Video
A 0271 Canon/JVC/Panasonic Video

Plus Your choice of a Free Adaptor plate valued at $12.95!

Supplied with Car Cigarette Lighter Lead, Mains Plugpack and AA Adaptor Plate!

Professional Rack Frames & Panel Sets

Featuring an industrial strength black powder coat finish and made in Australia, they conform to standard rack frame specs.

Great for Audio Visual Systems, Hi-Fi, Home Theatre, etc.

Cat. No.		Height	Was	NOW
H 5512	**12U** Frame	633mm	$193	**$139**
H 5612	**12U** Panel Set		$135	**$97**
H 5515	**15U** Frame	764mm	$203	**$146**
H 5615	**15U** Panel Set		$150	**$108**
H 5518	**18U** Frame	903mm	$222	**$160**
H 5618	**18U** Panel Set		$160	**$115**
H 5524	**24U** Frame	1170mm	$261	**$188**
H 5624	**24U** Panel Set		$189	**$135**
H 5530	**30U** Frame	1435mm	$280	**$202**
H 5630	**30U** Panel Set		$223	**$160**
H 5538	**38U** Frame	1792mm	$329	**$237**
H 5638	**38U** Panel Set		$272	**$196**

Save Hundreds of Dollars on Similar Custom Made Rack Frames, & SAVE up to 28%! Supplied in Kit Form, Assembles in Minutes

on-line o ring: www.altronic u • fax order line (08) 9328 3487

1-800 999 007 Perth (08) 9328 1599

overnight delivery*

ALTRONICS

Save up to 35% on UpTek Multimeters!

LIMITED STOCKS!

UpTek 30 Range Digital Multimeter

- Temperature -50°C to 1100°C
- Data Hold
- Auto Power Off
- AC Volts < 200mV - 750V
- DC Volts < 200mV - 1000V
- Resistance < 200Ω - 20MΩ
- Continuity Buzzer
- AC/DC Current < 200μA - 10A
- Diode Check
- Includes high quality test leads and shock-proof rubber holster!

Q 1102 WAS $109, NOW **$70**

FREE BITS! The first **20 callers** to purchase this fully-featured DMM receive a Q 1103 Thermocouple (which allows the Q 1102 to measure temperature), valued at $15 absolutely ***FREE!***

Auto Ranging DMM

- 32 Segment Bar Graph
- Manual Override of Autoranging
- Incorrect Lead Socket Beeper
- Range Hold & Data Hold
- Auto Power Off
- AC < 320mV - 750V
- DC Volts < 320mV -1000VDC
- Resistance < 320Ω - 30MΩ
- Continuity Buzzer
- AC/DC Current < 320μA - 10A
- TTL/CMOS Logic Tester
- Diode Check
- Includes high quality test leads and shock-proof rubber holster!

Q 1104 WAS $115, NOW **$80**

MORE FREE STUFF! Purchase the user-friendly **Q 1104** Auto Ranging DMM OR the feature-packed **Q 1108** LCR DMM and we'll throw in the P 0410 Universal LED Test Lead Lamp, valued at $8.95, ***FREE!***

43 Range LCR DMM

- 20MHz Frequency Counter
- Incorrect Lead Socket Beeper
- Peak Hold & Data Hold
- Auto Power Off
- Inductance • Capacitance
- Frequency • AC Volts
- DC Volts • Resistance
- Continuity Buzzer
- AC/DC Current
- TTL/CMOS Logic Tester
- Diode Check
- Includes high quality test leads and shock-proof rubber holster!

Q 1108 WAS $139, NOW **$95**

MICRON 20W Soldering Iron

PERFECT SETUP FOR THE BUDDING ENTHUSIAST!

This powerful 20 Watt soldering iron features a high efficiency patented heating element and a long life interchangeable iron-clad tip. It's supplied with a 1.6mm conical tip that is ideal for general assembly work. 3 different tip sizes available, 370°C fixed temp.

T 2420 ONLY **$29.95**

FREE ACCESSORIES!

Receive a T 1100 200g solder roll, a T 1310 Iron stand, together valued at **over $20**, ***FREE*** with every T 2420! ***BE QUICK! Limited to First 50 Callers Only!***

Mini 19 Range DMM with Square Wave Output

Small enough to literally fit in your pocket, this DMM is great for the mobile serviceman or student lab kit. Features square wave output and backlighting!

SAVE 25%!!

- DCV to 600V • ACV to 600V • DCA to 10A
- Resistance to 2000kΩ • Logic Test
- Continuity Buzzer • Transistor Hfe • Data Hold. **See our 2000 Catalogue Page 74 for full specs.**

Q 1124 WAS $26.95, NOW **$20**

MINI DRILL KIT!

Great for drilling PCBs, polishing, or engraving.

Includes two cutting disks, sand paper sleeve, engraving bit, four chucks and a PCB drill. A powerful high speed 12VDC motor will easily handle any task.

T 2303 WAS $31.45, NOW **$19.95**

12 Piece Tool Kit

SAVE 35%!!

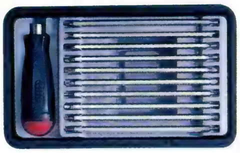
Contents:

- 3/16" Nut Driver • 1/4" Nut Driver
- Three Claw Part Holder • Tweezers
- T15 Torque Driver • 1/8" Flat Screwdriver • #0 Phillips Screwdriver
- #1 Phillips Screwdriver • 3/16" Flat Screwdriver • IC Extractor or Spare Parts Tube • 14-16 Pin IC Inserter

T 2150 12Pcs Took Kit
T 4002 Anti-Static Strap

Both T 2150 & T 4002 Were $36.20, NOW **$24.95** FOR BOTH!

Ratchet Screwdriver Set



This set contains a reversible ratchet driver handle and a set of double ended driver bits including 4 flat blade, 4 philips, 4 pozidrive, 4 hex and 4 TORX heads. The ratchet direction is selected by a handle switch. The set comes in a sturdy storage case. **T 2190**

Was $31.95, NOW **$21.95**

Handyman 120W Gas Soldering Iron

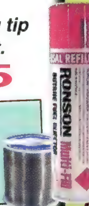
SAVE HEAPS!

The T 2598 eliminates the need to run out extension leads every time you want to solder something away from your work bench!

It features a "one-touch" piezo ignition for super-easy starting, and a thumb-wheel heat control. An absolute MUST for installers, mobile technicians, on-site service personnel, etc.

Supplied complete with soldering tip and bonus blow torch attachment.

T 2598 Was $72.50, NOW **$55**



BONUS DEAL! The first 40 callers to purchase a T 2598 receive a roll of T 1100 solder and a T 2449 Butane Refill, together valued at $10.85 FREE!

A Power Supply for Life!

Precision Digital LCD Volt and Current meters accurate to within 0.5%!

0 to 30V @ 5A

A lab supply with a main output rail adjustable from 0 to 30V, at up to a huge 5A.

M 8205 Was $345, NOW **$269**

SAVE $$$!

Features: • Separate controls for voltage and current limiting • Fixed 12V and 5V output rails, at up to 0.5A • Precision digital LCD Voltage and Current Meters for fine adjustment for use in research labs, instrumentation testing, digital circuits, etc.

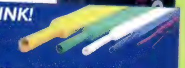
Flameless Heatgun

Reduces heatshrink quickly and effectively without burning it!

Features: • Regulated flameless heat output • Powered by a refillable gas cartridge • Trigger-actuated piezo electric starter • Safety lock to prevent accidental ignition • Compact and stylish

T 2480 Only
$36.50

BONUS FREE HEATSHRINK!
Buy the T 2480 and receive a BONUS W 0880 Hobby Heatshrink Pack Valued at $15.75 at no extra charge!



Brymen® Multi-Function DMM

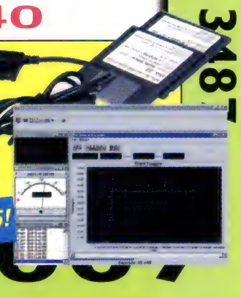
*The Brymen® **Q 1080** digital multimeter is truly an amazing piece of test equipment with features only found in meters 2 or 3 times the price! One of the handiest features is the EF function, in short, this function will enable the user to detect 240VAC mains without even connecting a single test lead!*

Features: Auto ranging • EF Detect • Data Hold • Temperature • AC/DC Voltage 250mV–750V • AC/DC Current 250μA–10A • Resistance 250Ω–25MΩ • Diode Check & Buzzer • Optically Isolated RS232 Interface (Q 1082)

240V Rated. Meets ENG1010–1 IEC1010–1, CATII 1kVDC/750VAC, CATIII 600VAC/DC with 6.5kV transient protection!

Q 1080 Was $160, NOW $140

SPECIAL OFFER!!



Every Q 1080 purchased includes a FREE Q 1082 Optically Isolated RS232 Interface + Software to turn your meter into a fully fledged Data Logger (Valued at $26.95)

TOTAL SAVING OF $46.95!

on-line ordering: www.altronics.com

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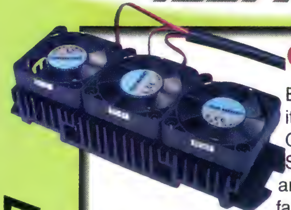
1-800

ALTRONICS

overnight delivery *



CPU F@ns!

Ensure your CPU keeps its cool under pressure. Great for overclockers. Suit Pentium processors, and feature ball bearing fans for long life.

Fans to suit Pentium II processors

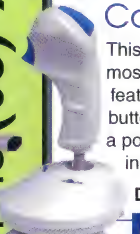
F 2012, 2 fan model Only $24.95

F 2013, 3 Fan model Only $34.95

Fans to suit Pentium III processors

F 2014, 2 Fan model Only $26.95

F 2015, 3 Fan model Only $36.95



Computer Joystick

This stylish joystick is suitable for most IBM compatible computers, it features 2 fire buttons and 2 preset buttons. Will suit most games, it has a positive feel self centring stick making it a breeze to use.

D 2040 $17

BUY ONE, GET ONE FREE!

Cooling Fan Alarm

This self contained module installs between the CPU cooling fan and the power supply. It monitors the fan and in the event of fan failure it sounds an audible alarm. It's cheap insurance for your expensive CPU! Suitable for 2 or 3 wire fan setups.

D 3900 Normally $22.95,

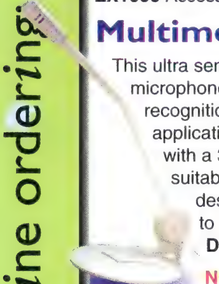
Introductory Price Just $18

Computer Workstation Kit

Spruce up your PC with this kit of computer accessories! It includes a pack of anti-static cleaning wipes, a keyboard cover, monitor cover, a document holder, a pen holder and a mouse pad. ***Normally valued at $38.60!***

ZX1000 Accessories Kit JUST $15

Multimedia Mic



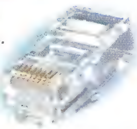
This ultra sensitive "plug and play" microphone is ideal for use for voice recognition, internet phone, multimedia applications, interactive games. Fitted with a 3.5mm jack plug and is suitable for all sound cards. Can be desk mounted or direct mounted to your monitor.

D 0900 Was $9.95,

NOW $6.95

Modular Connectors

Over 50% OFF In packs of 100!



Make up your own patch leads or replace dodgy connectors with these high quality crimp RJ45s.

P 1418 Were 95¢ ea,

NOW .45¢ ea

In Packs of 100

Colour Boots

Colour code your leads so you can tell them apart.

P 1851 Red **P 1856** Yellow

P 1861 Blue **P 1866** Grey

All Were 50¢ ea, NOW ONLY

.24¢ ea In Packs of 100

Dyna-Link® Cat 5

Buy the box & SAVE 25%!

FINALLY, Cat 5 Cable at Bargain Basement Prices!

W 2750 Was .90¢ per m,

ZX2750 **305m box & free punchdown tool**

.64¢ per metre

FREE T 1610 Handy Stripper & Punchdown Tool, valued at $6.50, with every box! (While stocks last)

Wireless Mouse

with Scroll Wheel

This unit solves the problem of getting your mouse cable caught on objects on your desk. It doesn't even have a cable! Instead it uses a wireless link. It's suitable for most IBM compatible computers with a PS/2 port. Microsoft® Windows® compatible. Includes software.

WIRELESS!

D 2065 Was $49.95, NOW $39.95

Keystone® Wallplates

Standard & Enhanced Cat-5!

Supplied complete with connectors, the D 5110/2 wallplates suit standard electrical wallbox. Available in single or dual sockets.

Standard Cat-5 Wallplates.

D 5110 Single Was $12.60, NOW $9.50

D 5112 Dual Was $21.95, NOW $16.50

D 5100 Spare Jack Was $9.40, NOW $6.75

Enhanced Cat-5 Wallplates.

D 5113 Single Was $12.60, NOW $9.50

D 5114 Dual Was $21.95, NOW $16.50

Surface Mount Jacks

The D 5115/6 surface mount jacks are ideal for fixing to concrete slabs,etc.

D 5115 Single Was $10.25, NOW $7.25

D 5116 Dual Was $16.55, NOW $11.75

LAN Cable Tester

The quick and easy way to test field wiring. Simple operation will save you hours of frustrating fault finding.

Features:

An absolute must for computer techs & installers!

- Auto/Manual mode
- LED indicators for all connections including Ground
- Will test 10Base-T, 10Base-2, RJ45/11, 258A, TIA 568A/568B and Token Ring
- BNC to RJ45 Adaptor lead included
- RJ45 to RJ45 Adaptor lead included
- Includes Soft carry case

D 3007 Was $119

NOW $99

CD Protection Kit

Keep your CDs safe from scratches and dust with this easy to use clear film kit. Ideal for music CDs used in cars where they may be easily scratched, and may also be used for computer software CDs.

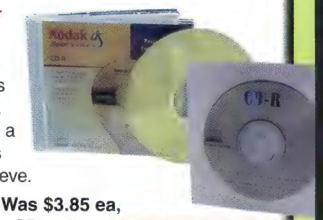
D 0260 CD Film Application Kit (includes 5 films)

Was $7.95, NOW $5.95

D 0262 Pk20 Extra Films

Was $19.95 pk, NOW $15.95 pk

BARGAINS ON CD-Rs!



BUY IN BULK AND SAVE HEAPS!! Stock up on CD-Rs, including the top-spec Kodak Gold! All three types are 650Mb/74min capacity. Kodak CDs are supplied in a jewel case, economy types are supplied in a paper sleeve.

D 0240 Kodak Gold CD-R **Was $3.85 ea,**

ZX0240A Pack 10 with free CD wallet

ZX0240B Pack 10 with free CD rack

NOW $2.80 ea in Packs of 10

D 0244 Gold/Gold CD-R **Was $3.00 ea,**

ZX0244A Pack 10 with free CD wallet

ZX0244B Pack 10 with free CD rack

NOW $2.20 ea in Packs of 10

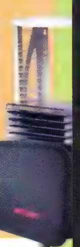
D 0246 Blue/Silver CD-R **Was $2.20 ea,**

ZX0246A Pack 10 with free CD wallet

ZX0246B Pack 10 with free CD rack

NOW $1.80 ea in Packs of 10

BONUS DEAL! Buy 10 of any CD-R & receive either an A 9250 20 CD Wallet or an A 9255 20 CD Rack (valued at $10.45) absolutely FREE!



CD Jewel Cases

If you purchase either the D 0244 or D 0246 CD-Rs, you might require jewel cases for them. Or, they're ideal for replacing tatty cracked cases on your computer or audio CDs.

D 0410 95¢ ea in Packs of 10

Mobile Hard Drive Bays

Includes built-in Cooling Fan!

OVER 30% OFF!!

Need to transfer large amounts of data between two locations or do you require a multi-purpose slot in your case?

Features Power & HDD activity LED display, fan cooling. Great for 3.5" hard disk drives, ZIPs, LS-120, DATs.etc.

D 5500 IDE **Was $29.95**

D 5510 SCSI **Was $29.95**

Both NOW ONLY $20 ea

Multimedia Speakers

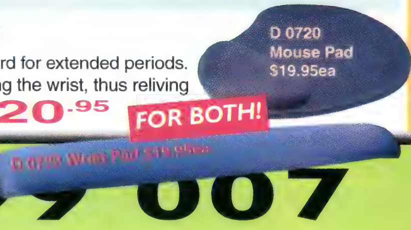
These speakers are magnetically shielded for use next to a monitor. They have a separate volume control, a headphone socket and are mains powered. ***Great for games effects or for listening to CDs!***

D 0800 Was $22.95,

NOW $14.95

Add multimedia to your PC!

Ergonomic Silicon Gel Pads



D 0720 Mouse Pad $19.95ea

D 0730 Wrist Pad $19.95ea

Great for people who are using a mouse and keyboard for extended periods. Features an in-built ***silicon gel cell*** pad for supporting the wrist, thus reliving stress and fatigue. ZX0050 Mouse & Wrist pad $20.95 FOR BOTH!

on-line ordering www.altronics.com.au fax order line (08) 9328 3487

1-800 999 007 **Perth (08) 9328 1599**

overnight delivery*

ALTRONICS

NiCad Batteries

NiCads will eventually pay for themselves, and can provide hundreds of recharges if cycled periodically. They can be used in just about any battery powered appliance.

S 4705 700mAh **AA Cell** Normally $2.65 ea,
NOW $2 ea, 10 & up, or $1.60 ea, 25 &up

S 4711 2500mAh **C Cell** Normally $12.10 ea,
NOW $6 ea, 4 and up, or $4 ea, 10 & up

S 4715 1500mAh **D Cell** Normally $7.60 ea,
NOW $5 ea, 4 and up, or $4 ea, 10 & up

S 4720 100mAh **9V Cell** Normally $13.60 ea,
NOW $10 ea, 2 and up, or $7 ea, 4 & up

Premium Quality Rechargeable Cells! At these prices, it won't take long for these to pay for themselves compared to carbon or zinc-alkaline batteries!

AAA NiMH Batteries

Nickel Metal Hydride batteries don't suffer memory effect to the extent that NiCads do.

S 4741 500mAh **AAA Cell** Was $4.75 ea,
NOW $3 ea, 8 & up

12V Negative Ion Generator

Keep your car smelling fresh with this little ionizer. *Stop your car smelling like a stale ashtray!*

A 0120 WAS $16.95, NOW $7.50

PARTS DRAWERS!

BONUS DEAL!! Buy One AND...

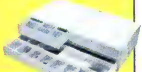
Excellent for storing all sorts of small items like resistors, capacitors, fuses, etc.

Keeps your spare parts and components nicely organised, ensuring you can find that elusive part when you need it!

Please note: Components not included

H 0250 Small 14 Way ONLY $5.45
H 0252 Large 14 Way ONLY $8.00
H 0254 Large 15 Way ONLY $8.00

GET ONE FREE!



Magnifying Glass!

Features a built-in light and a double magnification lens section.

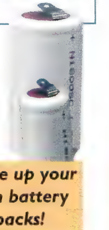
A 0960 WAS $10.45, NOW $7.50

Learning UHF Remote Control

This miniature learning remote control can be used as a replacement for your car remote control or to combine more than one remote. ie. Garage door, car, motorbike, home alarm, etc. Very easy to program, just copy the code from your existing remote. *• Four easily programmable buttons • Wide operating frequency 255-500MHz • Includes battery & key ring*

A 1015 Was $41.95, NOW JUST $30

NiCad Batteries with tags...



Sooner or later, your model racing car or cordless drill will stop when the batteries give up. Take advantage of these LOW PRICES to put some life back into your toys and cordless tools!

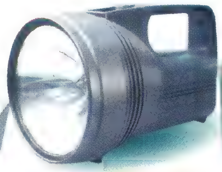
S 4605 800mAh AA Cell with tags
ONLY $3.50 ea, or $3 ea, 5 & Up

S 4608 1800mAh C Cell with tags
ONLY $6.80 ea, or $6.50 ea, 5 & Up

Make up your own battery packs!

Weather Resistant Torch

FREE



A 0190 $7.95

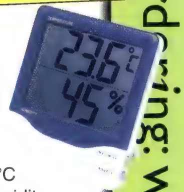
Set of 4 x 'D' batteries (Valued at $5.00)

Indoor & Outdoor Thermometer

Features: Dual display for internal/external temperatures • Memory function • External Sensor on 3m lead • Desk /wall mount **A 0145 Was $35,**
NOW $25

Ideal for use in hydroponics, garden centres, shade houses, monitoring air conditioning , aquariums, wine cellars, etc.

Thermometer & Hygrometer



Features • JUMBO LCD displays temperature & humidity • Memory function • -10°C to +50°C temp. & 25% to 95% humidity range with ±5% accuracy • May be mounted on desk or wall.

A 0155 Was $55, NOW $45

Thermometer & Hygrometer

with Min / Max Memory Recording

Simultaneous displays both temperature. Storage and recall of maximum and minimum temperature and humidity.

Great for wine buffs!

A 0150 Was $45, NOW $35

1RU RACK CASE SELLOUT!

OEM CUSTOMER CANCELS ORDER!

Ack! A client cancelled an order of custom 1RU rack cases, and we've got them at a *BARGAIN PRICE!* These black cases have a screened front panel with three LED holes in it. The back panel is punched to accept a fused IEC connector, and has five other holes punched: 3 x 12.5mm, 1 x 19mm and a rectangular 28 x 14.5mm. We have limited stocks of these, and once they're gone, they're GONE! *Our H 5011 case normally sells for over $75!!* **HX5011** JUST $30 or 2 for $50

Aussie Made Power!!!

This month Save $100 on these rugged 300W Powerhouses. Ideal for camping enthusiasts

This ***Australian Made*** inverter will generate 240V AC power from your car battery!

Features:
- Phase correction (will run fluorescent lighting)
- 600W surge
- Twin GPO power point.
- Power saving auto start
- Suitable to run small fridges, fluoro lights, televisions, incandescent lights, VCRs and small power tools.
- Available in 12V or 24V models

K 6755 , 12V input Was $435 NOW $335

K 6756 , 24V input Was $435 NOW $335

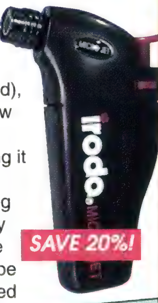
Computer Hardware Pack

Ideal for the home, workshop or mobile van!

Assorted fixing screws, standoffs, spacers, jumpers, etc as used in virtually all PCs. Supplied in a handy plastic box. Ideal for field service technicians, workshops, etc.

D 1000 ONLY $12.95

Micro-Jet Blow Torch



Powered by a refillable gas lighter (supplied), this unique blow torch burns at 1300°C, making it ideal for many types of brazing and heavy duty soldering. The Micro Jet can be ignited and used simply with one hand. It has an in-built piezo electronic ignition system which ensures easy lighting every time.

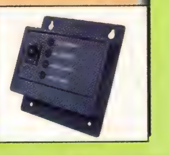
"This little blow torch has to be the niftiest tool of it's type we have ever seen!" **Silicon Chip Magazine**

T 2490 Was $26.50,
NOW ONLY $19.95

1300W 12VDC/240VAC Inverter

MASSIVE 4000W SURGE CAPACITY!!

The huge surge rating of this beast of an inverter means it's ideal for coping with the startup surge of fridges, freezers, pumps, grinders and microwaves. The unit will even power fluorescent lighting! The rugged, powder coated steel cabinet has lugs for wall mounting. It has a "no load shutdown" feature that powers down the inverter when no load is applied. This minimises the standby current draw from your batteries. The M 8141 Remote Control can turn the inverter on and off from up to 50 metres away (10 metres of cable is included with the remote)



M 8142 1300W Inverter **Normally $799,**
SPECIAL PRICE $699

M 8141 Remote Control Unit $109
M 8097 1.5M Lead set to suit $39

on-line ordering: www.altronics.com.au • fax order line (08) 9328 3487

Perth (08) 932

1-800 999 007

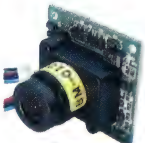
CCD CAMERA BARGAINS!

These CCD Cameras are ideal for use in security applications, and are virtually undetectable if installed discreetly. They may also be used around the home to keep an eye on the nursery or the pool.

B&W Camera in a diecast case with wide angle 130° lens field.

S 9001 WAS $120, NOW $79

M 9236 9VDC 300mA Plugpack to suit $14.85



PCB Camera module. 380 line resolution.

S 9010 WAS $119, NOW $69

M 9449 12VDC 500mA Regulated Plugpack to suit $31.85

PCB Camera module with on-board mic for audio pickup. 380 line resolution.

S 9011 WAS $115, NOW $79

M 9449 12VDC 500mA Regulated Plugpack to suit $31.85

With Audio!

B&W Camera in a diecast case with microphone.

S 9005 WAS $125, NOW $99

M 9236 9VDC 300mA Plugpack to suit $14.85

B&W Waterproof Bullet Camera. A fully sealed camera ideal for use in humid or water logged environments.

S 9085 ONLY $175

WATERPROOF!

M 9236 9VDC 300mA Plugpack to suit $14.85

Colour CMOS Dome Camera

COLOUR!

May be mounted on the ceiling in shops or homes. Their visible appearance gives them a useful deterrent value, and the dome prevents the ingress of dust or tampering.

M 9449 12VDC 500mA Regulated Plugpack to suit $31.85

S 9120 ONLY $189

PIR Detector with CCD Camera & Audio

This combination camera and PIR is an ideal low cost total surveillance solution for the small office, business or home. It's easy to install and connect with all mounting hardware supplied. Features N.O. and N.C. contacts for remotely controlling a VCR/TV for unattended recording. Requires regulated 12VDC supply. (M 9449 $31.85)

S 9040 WAS $208, NOW $179

Audio/Video UTP Extender

This compact system allows the transmission of a Video or Audio/Video signal from a camera for up to 600 metres (B/W) or 300 metres (colour) over standard UTP cable (Cat.5). ***Two*** units are required to form a link. 2 x S 9245s form a video link, whilst 2 x S 9250s form an AV link. No externa power is required.

S 9245 Video-UTP Converter
WAS $47.25, NOW 2 for $70

S 9250 A/V-UTP Converter
WAS $94.45, NOW 2 for $150

Colour CMOS CCD Camera With Audio

COLOUR!

A cost-effective way to get colour video, this tiny CMOS camera provides excellent 330 line resolution and even has an on-board microphone for audio pickup!

S 9060 WAS $188, NOW $150

M 9449 12VDC 500mA Regulated Plugpack to suit $31.85

B&W CCD Dome Camera

Infra Red illumination for night use!

May be mounted on the ceiling in shops or homes. Their visible appearance gives them a useful deterrent value, and the dome prevents the ingress of dust or tampering.

S 9112 ONLY $99

M 9449 12VDC 500mA Regulated Plugpack $31.85

Surveillance Package

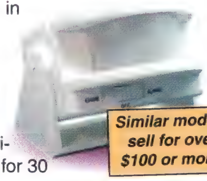
Includes B/W dome camera

A ***BARGAIN*** security surveillance system for shops and homes! Package includes the S 9090 6" B/W monitor, the S 9112 B/W & Infra-Red Dome CCD camera, M 9449 Plugpack, 10 metres of figure 8 shielded cable and the appropriate connectors to connect them up!

Normally Over $234 Value!

SX9999 ONLY $199

PIR Door Minder & Alarm



Similar models sell for over $100 or more!

An excellent unit for use in home, office, shops,etc. 2 modes: • Entry/exit chime activated by an external switch or by movement detected • Alarm mode, when activated the alarm sounds for 30 seconds. ***Features:*** • 10m detection range • Easy to install • Self-contained • Swivel mount bracket • Remote doorbell contacts • Doorbell only operation when in Off mode • Ideal as a travellers intruder alarm

S 5320 Was $41.95, NOW $25

M 9237 9V DC 500mA $16.45 Plugpack

Super Mini Colour CCD Dome Camera

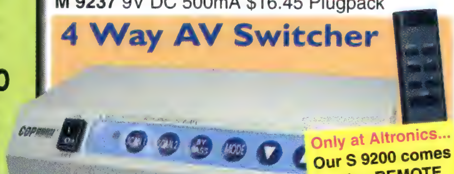
This *COLOUR* CMOS camera is housed in a dome only 54mm in diameter, and just 47mm high!

S 9120A WAS $189, NOW $150

M 9449 12VDC 500mA Regulated Plugpack to suit $31.85

LIMITED STOCKS!

4 Way AV Switcher



Only at Altronics... Our S 9200 comes with a REMOTE CONTROL included FREE!

Monitor up to 4 A/V channels with this advanced automatic A/V switcher. Any combination of the four cameras can be scanned and displayed on either of the two monitors, it switches both video and audio. The time and date is displayed on both monitors making it ideal for surveillance applications. The scan rate and duration of each camera can be configured using the on screen menu functions.

S 9200 Was $235, NOW $199

Professional B/W CCD Camera

with Audio and Auto Iris Capability

This compact camera is a professional quality unit that can accommodate CS or C mount lens (not included, see list below) and is compatible with an auto iris lens. The inbuilt mic provides excellent audio pickup, and the whole camera may be mounted in the S 9170 weatherproof enclosure for outdoor use.

S 9150 Camera **$129**

M 9449 12VDC 300mA Regulated Plugpack to suit $31.85

Lenses to suit: S 9180 4mm, **S 9181** 6mm, and **S 9182** 8mm **ALL $39.95**

Auto Iris Lens

Genuine Japanese Tokina® brand suitable for use with the S 9150 camera. Used where camera field lighting conditions vary. Servo controlled aperture from f1.4 to f64. Fixed 4mm focal length.

S 9193 Auto Iris Lens **$269**

Video Door Phone Intercom

No need to ever open your door to strangers again!

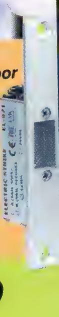
This intercom allows you to see and listen to whoever is knocking at your door before you open your home to them.

Features:

- Simple to install
- Includes CCD camera with IR illumination
- Camera activates as soon as the doorbell is pushed.
- Two way communication is possible through the telephone hand set and microphone.
- Camera and monitor can be up to 100m apart (15m lead supplied)
- Tamper switch on the camera unit is compatible with most security systems
- Monitor may operate an electric door strike (S 5385) so you can "buzz" your visitors in.
- Includes 18V DC Plugpack.

S 9400 Only $399

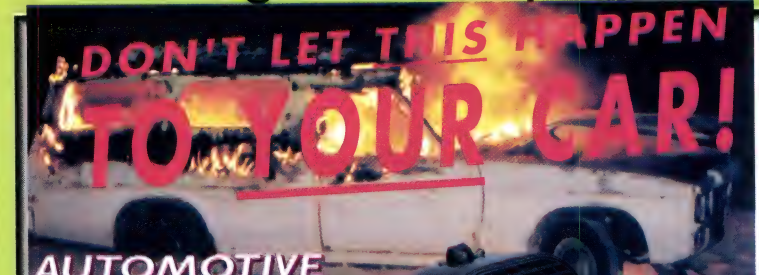
The addition of this electric door latch allows you to automatically open a door or gate once you have spoken to your visitor.



S 5385 $47.20

overnight delivery*

ALTRONICS

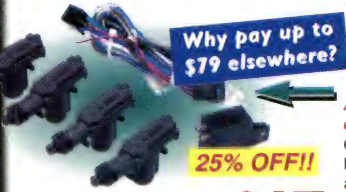


AUTOMOTIVE ANTI-THEFT SYSTEM

Why pay a security company to install an alarm when you can do it yourself and save a fortune?
Features: • Multi-function remote • "Smart" two-stage shock sensor for a more accurate detection • Starter immobiliser • Valet mode • Selectable auto arming, • LED Status indicator and a myriad of user programmable options. (Refer to our 2000 Catalogue for more details page 61)

SAVE $60!

S 5202 WAS $189,
NOW $129



Why pay up to $79 elsewhere?

25% OFF!!

Central Door Locking Kit

All four doors will lock or unlock with the operation of either of the front doors by simply adding this kit!
Can be interfaced to our S 5202 car alarm (and others) to lock or unlock all four doors when the alarm is armed or disarmed.• Includes 4 solenoids, control unit, wiring harness & all mounting hardware. Suits 12V negative earth systems.

S 5242 Was $62.95, NOW $47

NESS Quantum PIR Detector

WITH PULSE COUNT TRIGGERING

SUPER RELIABLE
Of the 1,000's we've sold, not one returned!

Features: • Only 65w x 80h x 45d mm • Selectable Pulse Count • Pyroelectric Sensor • True 15m x 15m 90° Detection Pattern • Surface or corner mount • 9-15V DC • Suits most alarm panels • N.C. Alarm contacts in standby condition • N.C. Tamper switch • Adjustable Beam Height Angle • User selectable walk test LED, single pulse or triple count modes & range control **S 5305 Were Up to $40.95,** NOW $29 ea, 2 up

SAVE OVER 35%!

Dual Output PIR Detector

DUAL OUTPUTS: **The dual relay output is ideal for triggering, say, a VCR as well as the alarm system when an intruder is detected.**
Features: • Excellent RFI Immunity • White light Immunity • Insect-proof housing • Temperature compensation • Self-testing software • Tamper protection • **Dual relay output** • Includes unique corner mount mounting bracket • Adjustable coverage area

S 5307 WAS $62.95, NOW $40

State-of-the-art Digital Signal Analysis virtually eliminates false triggering!

Dual Detection PIR

Features: • **Double twin optics for improved detection • Auto temperature compensation • Suits many alarm systems • Vertical adjustment for detection angle • Normal or Pulse count modes**
Alarm systems with standard P.I.R's are prone to false triggering. The S 5309 features double twin optics which reduces the number of false triggers, all at the price you would expect to pay for a standard P.I.R.

S 5309 WAS $57.75, NOW ONLY $49.95

New Improved Detection Technology!

AV-GAD

The AV-GAD range of alarm panels and accessories are by far the most versatile and feature packed systems we have evaluated. They are a result of 12 years extensive research and development and are used by the Swiss and Israeli military. The systems are controlled by a powerful microprocessor and are constructed using ultra-reliable surface mount technology.

Features
- Programmable auto-dialler may dial up to 4 different numbers
- Compatible with most security company monitoring systems
- Inbuilt modem for remote programming & monitoring
- Auto-arming function • Programmable alarm response modes
- Home and away modes • Optional 22 second message recorder
- Optional wireless remote control (A 1018)
- Time & date log of alarm events, ie arming, disarming, triggers etc
- Up to 8 user and installer codes (up to 6 digit codes)
- Accommodates Normally Open (NO) & Normally Closed (NC) sensors
- End-Of-Line resistors maintain sector integrity
- Steel main cabinet with RF emission protection
- 24 hour zones and dedicated fire alarm sector
- Auto-bypass of triggered instant sectors upon arming
- Supplied with separate User and Installer manuals
- Discrete entry delay times for two different sector groupings
- Alarm sensor and Tamper loop on a single pair of wires
- Instant, one-button arming
- Unique siren tones for 24 hour & panic zones, normal alarm & fire alarm
- Transformer power supply included (No plugpack required)

Security System Package

5 Sector Package

S 5112 Deluxe Keypad	159.00
S 5105 5 Sector Alarm Panel	249.00
3 x S 5290 PIR Sensors	177.00
S 5090 7.2Ah Backup Battery	39.95
S 5415 External Siren/Strobe	30.40
S 6120 Internal Siren	19.80
2 x S 5400 Warning Stickers	4.10
2 x S 5153 Reed Switches	12.50
200m W 2360 6 Core Cable	95.00
Total Normal	**786.75**

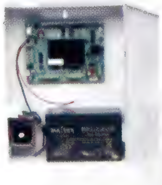
Includes the S 5112 DELUXE KEYPAD!

S 5102 5 Sector Deluxe Package
$690

5 Sector Home & Business Security System

The S 5105 has a range of features which make it suitable for a host of applications from homes to commercial installations. It features auto arming, allowing the alarm to be set to arm at a specified time eg. one hour after lock-up time, which ensures the system is always secure. The internal auto dialler can be programmed with up to four phone numbers (including mobiles) and also has a "follow me" feature enabling you to leave a forwarding number each time you exit the premises. A log of alarm events such as arming/disarming, trigger conditions and power failures is stored in internal memory. The log may be downloaded to a PC via the optional RS-232 interface and software (S 5135).

With Inbuilt Dialler for Remote Monitoring!



S 5105	5 Sector Panel WAS $249, NOW	$199
P 8400	7.5A 3 Pin Mains Lead (2m) to Suit	$4.15
S 5075	1.3Ah Backup Battery to Suit	$19.95
S 5090	7.2Ah Backup Battery to Suit	$34.95

Keypad To Suit

AV-GAD's EasyLoader keypads are a reliable and user-friendly control interface to the 5 sector alarm panels.
Features for both models:
Time stamped event log. • 7 segment zone display reports alarm status and event log. • Simple 4 wire connection. • Individual bypass of zone or group of zones. • LED indicators for Alarm Triggered, Fire, Zone Shunt and Armed Status. • Low battery indicator • Key press beeper (selectable). • Backlit keypad with auto-shutoff
Deluxe model features: Stylish flip down front cover • Tamper switch • Can be mounted up to 200m from the main panel.

S 5110

S 5112

S 5110 Standard Keypad
$125

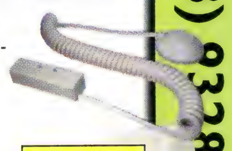
S 5112 Deluxe Keypad $159

PC Interface

The "EasyLoad" software and RS-232 adaptor enables the 5 & 8 sector systems to be controlled remotely from a PC.
S 5135 WAS $139,
NOW $99

Glass Break Detector

Fitted with a flexible curly cord to allow fitting to door or window. N.O. Contacts.
S 5367 WAS $39,
NOW $29



Weatherproof Strobe / Siren

NEW!

A combination 100dB @ 50cm siren and blue alert strobe in a single weather resistant housing! Requires 10-14VDC @ 280mA.
S 5415 WAS $30.40, NOW $24.95

n-line ordering: www.altronics.com.au • fax order line (08) 9328 3487

Perth (08) 9328 1599 **1-800 999 007**

ALTRONICS

overnight delivery *

on-line ordering: www.altronics.com.au • fax order line (08) 9328 3487

Coaxial Speakers

Less than 1/2 price!

200mm, 8Ω, high performance coaxial drivers suitable for high power installations. Massive 100W Max.

C 2005
Was $57 ea,
NOW
$50
Per Pair

Slimline ceiling grills to suit.
C 0805
NOW
$4.80ea

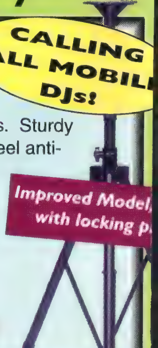
5 Input Stereo DJ MIXER

A super-compact stereo mixer designed with the DJ in mind. Features 3 inputs: one for mic and two for music sources. Music source inputs are switchable between line or phono levels, so CDs and/or turntables may be used. Also features a crossfader, cue volume, pre-fade listen and LED level meters. Includes 12VAC plugpack.

A 2545 WAS $99, NOW $79.95

HEAVY DUTY Speaker Stand

CALLING ALL MOBILE DJs!



Improved Model with locking p

Adjustable height from 1 to 2 metres. Sturdy aluminium tube construction with steel anti-sway bars and heavy duty plastic fittings. Folds down for easy storage and transportation. Comes with T-piece for mounting to speaker boxes, or will fit a 'top-hat' adaptor. Great for raising speakers and lighting to audience level.

C 0521 Was $109, **NOW $99**

SERIOUS PECC Bass Drivers

AMAZING VALUE! Perfect for hi-fi or car audio subwoofers! SAVE UP TO 40%!!

If you like your bass loud, these 8Ω bass drivers are for you. They feature poly emulsion coated cones (PECC) with rubber surrounds, low Q and high efficiency. Manufactured exclusively for Altronics, to our own specifications, they're ideal for subwoofer enclosures in Hi-Fi, Home Theatre or Car Audio systems.

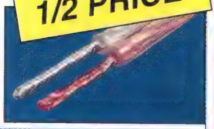
	Was	NOW
C 3022 165mm (6.5") 60W	$48	$29 ea
C 3024 200mm (8") 100W	$68	$45 ea
C 3030 300mm (12") 160W	$165	$89 ea

Ordering from Altronics is easy!

You can order via the telephone, fax or even over the Internet! Our 14 day money-back satisfaction guarantee means you can purchase with peace of mind. And our Jetservice delivery gets your purchase to your door quickly!

Whopper Wire!

OVER 1/2 PRICE!



SUPER HEAVY DUTY speaker wire. Figure 8 90/0.18, translucent insulation.

W 2130
Was $2.90 a metre,
NOW $65 50m Roll

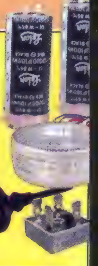
CHECK ELSEWHERE IN THIS FLYER FOR A GREAT DEAL ON STAGE TAPE!

200W MOSFET Amp Module Kit

(EA Dec '89) One mono module - no power supply or case. Fantastic for use in stage amps, Juke boxes, amplifier racks (multi-amplifier setups) discos etc. Huge grunt for use with subwoofer enclosures, DJ amplifiers or PA and sound reinforcement applications. Requires ±69V DC power supply.

K 5170 Normally $99, NOW $79

AMP PACKAGE DEALS!!



Option 1 Mono Block (ZX5170A)
K 5170 Module plus M 5750, Z 0091, R 6742 x 2, P 8400
Normally $291.40, **NOW ONLY $209**

Option 2 Stereo Block (ZX5170B)
K 5170 x 2 , M 5750, Z 0091, R 6742 x 4, P 8400
Normally $454, **NOW ONLY $329**

High Power Piezo Dome Tweeters

Great for DIY DJ Bins!!

Rectangular 230 x 125mm Horn Tweeter
200W Max Power, 105dB @ 2.83V/1m
C 6175 $25 ea, or $45 pair *Was $40.95 ea*

Phase Aligned 174 x 130mm Cluster Tweeter
400W RMS Power, 105dB @ 2.83V/1m
C 6180 $50 ea, or $80 pair *Was $93.45 ea*

Round 63mmØ Polycarbonate Dome Tweeter
150W Max Power, 108dB @ 2.83V/1m
C 6205 $12 ea, or $20 pair *Was $20.95 ea*

Round 74mmØ Polycarbonate Dome Tweeter
200W Max Power, 108dB @ 2.83V/1m
C 6215 $20 ea, or $35 pair *Was $33.60 ea*

500W Amplifier Module Kit

What a Beast! 500W into 4Ω!

HUGE 500W! Great for DJ amps, component subwoofers, instrument amplifiers, even PA systems!

(See SC Aug '97) Just the thing to power dedicated subwoofers, DJ, PA or party amps or the like. Silicon Chip claims it's the biggest amplifier ever published in a magazine and they'd be right. ***Features*** • 500W RMS into 4 ohms , 278W into 8 ohms (-0.3dB @ 20hz and 20KHz) • Input sensitivity 1.43V (at full power into 8 ohms) • Distortion typical less than 0.01% • Signal to noise 117db un-weighted 122db A-weighted • Supplied with the PCB and the components to populate the board, requires a heatsink and power supply ***(requires ±80V DC)*** **K 5190 WAS $230, NOW JUST $149**

Beat Triggered Strobe Kit

(See SC Aug '98) *Features* • Variable rate and sensitivity for beat settings • Line source inputs for beat triggering • Selectable beat / continuous functions • Easier to construct than earlier versions • Powered from a standard 240V mains source • MDF box, carpet, robust aluminium reflector *(unlike others on the market)*

K 5792 Normally $159, NOW $129
K 5797 Two tube option $18.95

BE QUICK! Free Two Tube option kit with the first 10 orders!

12V Halogen Discolight Kit

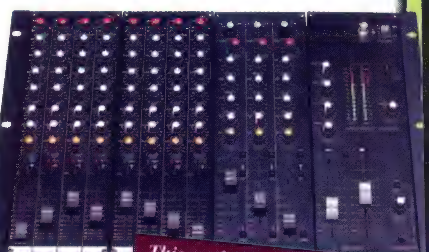
(See SC Jan/Feb '98)
Features: • 4 channels (20W or 50W halogen lamps) • Forward, reverse and auto reversing chaser patterns with music modulation • Simultaneous strobe on all channels • Alternating light patterns • 12V DC or AC operation • Input from loudspeakers, aux level or mic ***(Lamps not supplied).***

K 5807 Was $159, **NOW $129**

FREE!! 8pcs of X 2005A Lamp Holders Valued at $83.60

11 Channel Professional AV Mixing Desk

Incredible value! This professional AV mixing desk has a host of features that you would expect to find in mixers well over twice the price.



Desk Inputs: 11 inputs consisting of 8 mic/line channels and 3 stereo line input channels. The stereo inputs have 7 switch selectable source inputs with start/stop control for each of those 7 sources.

Desk Outputs: Two separate level controlled outputs; Master L & R (balanced XLRs) and Monitor L & R (RCAs), Record L & R (RCAs) - this output is pre-master fader connected Aux 1 & 2 Master send and return level controls.

Features: • Conforms to 19" rack mount dimensions • Faders for all channels • Pan for all channels • PFL on all channels • EQ defeat on all mono channels • Gain controls for all channels • Remote start for CD Players & Turntables • Separate level controls for Send & Returns on Aux. 1 & 2 • 3 Band EQ on all channels (sweepable mids on mono channels) • LED peak level indicators • Separate monitor level control • BNC light socket

This professional 8 Microphone, 3 Auxiliary mixing desk is ideally suited for use in Clubs, Hotels, Casinos, Churches, Cabaret Bars, Karaoke Bars, Schools, Theatres and Live bands.

A 2650 Normally $998, **NOW ONLY $780**

SAVE $218

1-800 999 007 Perth (08) 9328 1599

12 months minimum warranty*

ALTRONICS

BE QUICK! 18 ONLY!!

Anemometer (Wind Speed Meter) Kit

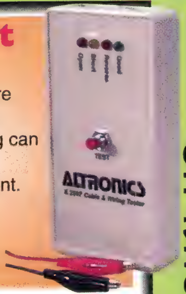
(SC March '99) Based around a simple bicycle computer and a few mechanical parts you can assemble and install this in just minutes.

K 1160 WAS $69.95, NOW $40 SAVE OVER 40%

Audio Cable Tester Kit

(See EA Nov '97) Nearly 90% of all faults occurring in audio installations are due to a wire that has come out of a connection point or has broken due to heavy handedness. Fault finding can be a time consuming process. This project identifies short or open circuit wires in an instant. Supplied in a silk screened case with battery compartment. Powered by a 9V battery.

K 2567 WAS $29.95 NOW $19.95



4 Channel Audio / Video Switcher Kit

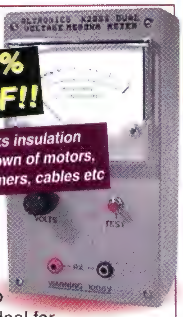
Why pay a fortune for a commercial camera switcher? Build your own and save $$$!

This kit can cycle through up to four A/V channels (cameras) and connect them to a monitor or VCR in turn. The sequencing rate can be adjusted and a pause button or switch can easily be added to stop switching for a longer look at a channel or camera.

K 5840 Was $34.95, NOW $29.95

Megger Meter Kit

25% OFF!!


Checks insulation breakdown of motors, transformers, cables etc

(See EA May '89) Features a dual voltage of 500 and 1000V with a large scale meter. It can resolve resistance from 1M to 200M ohm which is ideal for insulation testing

A must for checking earth leakage!

K 2555 Normally $79, Now $59

Sub-Bass Processor Kit

This kit can be used to get the most out of your subwoofer or low-bass speaker system. It can be used to compensate for poor or "peaky" sub-woofer response, improve the low-end extension in a speaker and even reduce a subwoofer driver's cone travel. It features a bypassable subsonic filter set at 20Hz, a variable low-pass filter, a variable gain input stage plus a dual phase output for running a bridged amp.

Get the most out of your subwoofer with this processor kit!

K 5568 Normally $27.95, NOW $19.95

Surround Sound Decoder Kit

(EA May '99) This kit enhances a stereo signal by extracting the "hidden" front centre and rear ambience channels and a subwoofer output. It even has an adjustable surround delay. All outputs are line level.

Affordable Surround Sound!

K 5590 Was $120, NOW A CRAZY $85

Video Fader Kit

Add professional wipes and fades to your home videos!

(EA April '98) This kit allows you to add pro video effects such as horizontal and vertical wipes, fade-ins & -outs during your editing. It fades from white, black or selectable shades of grey, with a built-in signal enhancer to maintain a high picture quality during editing. You'll be surprised just how professional-looking your results can be simply by using this very easy to build kit! Powered by 12VDC plugpack (not supplied).

K 5875 Was $65, NOW $45

M 9271 12VDC Plugpack $14.85

Musical Doorbell Kit

FREE H 0201 JIFFY BOX INCLUDED

(See SC Nov '97) A simple little kit that can add a touch of interest to your doorbell! It can be "programmed", by setting resistor values, to play a sequence of nine notes when the doorbell is pushed. It's powered by a 9V battery or DC plugpack (not included).

K 1145 WAS $18.95, NOW $10.95

Mains Power Monitor Kit

(EA June '99) "Brownouts" occur when the mains power level varies without prior warning. This can easily damage mains powered appliances unless they are automatically switched off by a protection device such as this kit. It disconnects the power to the appliance when the mains voltage is outside the pre-defined limits, then re-connects the load after a defined timed delay. • Fully silk screened and punched panels • Upper and lower voltage threshold selectable from 215V to 260V in 5V increments • Adjustable time delay • Includes inbuilt switched mains socket

K 6048 Was $59.95, NOW $40

M 9271 12VDC Plugpack $14.85

Audio / Video VHF Transmitter Kit

Transmit an A/V signal over 20m and view it on a standard VHF TV!

This A/V Transmitter kit is useful for monitoring signals from surveillance cameras or for transmitting the output from your VCR to another room. The signal can be received with a normal television set up to 20m away! It also has a 12VDC output for powering a camera or audio source. Requires 12VAC plugpack (not included).

K 5865 Was $59.95, NOW $40

M 9265 12VAC Plugpack $15.95

LED Xmas Light Controller

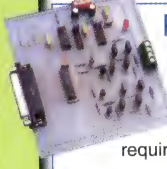
Ideal for shop window displays or Christmas trees!

(See EA Dec '97) This little project consists of 5 strings of super bright LED's that flash in a random pattern to jazz up your shop display or xmas tree!
• Variable flash rate • Low Voltage (Suitable for kids) • Easy construction • Complete with LEDs and silk screened case.

K 1150 WAS $24.95 NOW $15.95

M 9265 12VAC Plugpack $15.95

PC Stepper Motor Controller Kit



(SC Oct. '97) This kit allows control over a single stepper motor via the parallel port of a PC! Uses include control where a *precise* number of turns or revolutions is required. Supplied in short form, requires a 12V DC power supply.

K 2835 Normally $32.50, NOW JUST $20

160VA 12V Toroids!

SAVE UP TO 35%!

Ideal for power supplies, battery chargers, etc.

HUGE SAVINGS on surplus stock of these high quality toroids!

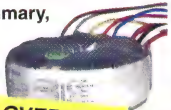
M 5313A 240V Primary, 12V Secondary

Was $49.95, NOW $35 or by 2 for $60

160VA 15V+15V Toroids!

Ideal for power supplies, battery chargers, etc.

M 5315A 110V + 110V or 130V Primary, 15V Secondaries



Was $52.50, NOW $35 or by 2 for $60

SAVE OVER 35%!

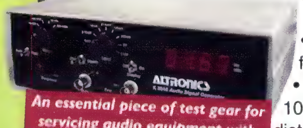
LED Audio VU Meter Kit

This easy to build level meter displays a peak reading from -21dB to 6dB in bar or dot mode. Build it into a DIY amp, disco mixer or monitor console! Powered from 7 to 15V DC.

K 5412 Was $23.95, NOW $18

Low Distortion Audio Signal Generator Kit

(SC Feb '99) A low distortion wide frequency audio oscillator is a useful piece of bench test equipment for enthusiasts or technicians • screened and punched perspex front panel • display on/off switch • float/ground switch • 10Hz - 100kHz in 4 ranges • low distortion • Output 3.16Vrms sine wave max, 3.16 V peak square wave. • Output impedance 600Ω • Sync output • high slew rate • digital readout. *See our 2000 Catalogue for full specs.*


An essential piece of test gear for servicing audio equipment with the bonus of digital precision!

K 2548 WAS $199, NOW $129

on-line ordering: www.altronics.com.au • fax ord ne (08) 9328 3487

Perth (08) 9328 1599 1-800 999 007

ALTRONICS

14 day money back guarantee*

UpTeK Inductance & Capacitance Meter

An essential piece of test gear for designing crossovers, power supplies, RF circuits, etc. • 3.5 Digit LCD • Continuity & Diode Test • Auto Power Off • *Includes shock-proof rubber holster* • 20μH-20H Inductance Range • 200pF-20,000μF Capacitance Range • Continuity Buzzer • Diode Check • Zero adjust for capacitance & inductance ranges

Q 1150 Normally $115, **NOW $99**

Modular Crimp Tool

This NEW ratchet action modular tool crimps all modular connectors from 4 to 8 way in a flash! It also has a built-in cable stripper and cutter. The solid all metal construction will ensure you get years of use from this quality tool.

OVER 25% OFF!!

T 1571 Was $175, NOW **$129**

1.5A Regulated Supply

Delivering 3V, 4.5V, 6V, 7.5V, 9V and 12V at up to 1A continuous capacity, the output voltage varies only minimally from full load to no load making it ideal for voltage sensitive devices like portable TV sets, video games, tape recorders, radios, scanners, computers.

SAVE 25%! Includes Short Circuit, Thermal & Overload Protection!

M 8230 Was $47.25, NOW **$35**

14 Day Money Back Guarantee* *Refer to page 16

IRODA Pro Torch

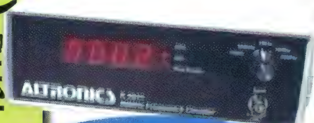
This superb blow torch is great for model making, heatshrinking, brazing, silver soldering & more. Push-on, push-off operation so you don't have to hold the trigger to keep it lit! Piezo ignition system for a reliable start every time. Refillable storage chamber allows up to 220 minutes of use.

Simple piezo electric push-on, push-off operation!

T 2495 Normally $68.50, NOW **$49** ea

T 2449 100g Butane Refill $4.35

50 MHz Frequency Counter Kit



(See EA Feb '93) *Commercial Frequency Counters can cost up to $400 or more, build your own and save!* This frequency counter kit offers high performance without a high price tag. Features include an accurate 4 digit LED display, 5 ranges (10kHz, 100kHz, 1MHz, 10MHz, 50MHz) and a BNC input connector. Kit comes complete with silk-screened and punched panels and red filter screen!

BE QUICK, only 12 left at this insane price!!

K 2512 Normally $99 **NOW ONLY $69.95**

DMM CARRY CASE & HOLSTER!

These were for a Q 1075 DMM which we no longer sell, but chances are they could fit ***your*** multimeter! Approximate DMM size is 74W x 30D x 150Hmm.

Q 1076 & Q 1077 Were $12.50 each, ZX1076 BOTH FOR **$10**

Aluminium Equipment Case

SAVE UP TO $24.75

This quality aluminium tool case measures 460 x 325 x 150mm. ***Features all aluminium side panels, unlike others around which have plastic panels!***

T 5020 Was $61.95, NOW **$55***

*Tool shown in case not included

FREE SCREWDRIVER SET TO THE FIRST 50 CALLERS!

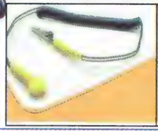
FREE T 2193 8pc Insulated Screwdriver Set (Valued at $17.80) for the first 50 callers to purchase the T 5020 Tool Case!

Bench top Fume Extractor Fan & Filter

Features: • Powerful 120mm fan (95/115 CFM) • Swivel Adjustment to easily angle unit to the job • On/Off Switch • Filter simply unclips for cleaning • 240V Operation

NO-MORE CHOKING ON SOLDERING FUMES!

T 1290 Was $145, NOW ONLY **$99**



FREE!

The first 50 callers will receive a Large 55 x 30cm Anti-Static Mat & Wrist Strap ABSOLUTELY *FREE!!* (Valued at $20.95)

33 Pcs Driver Bits

All housed in a handy plastic holder. Great for the toolbox. Suitable for use with battery drills or most hex bit drivers.

SAVE 25%!

T 2182 Driver Set contains: • 5 Slotted • 8 Phillips • 7 Pozi • 6 Hex • 6 Star • 1 Magnetic Bit holder

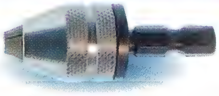
Were $13.95ea, ZX2182 Both sets ONLY **$20**

T 2180 Security Bit Set contains: • 4 Triwing • 9 Torx • 4 Snake Eye • 12 Hex (6 Metric & 6 Imperial) • 3 Torque • 1 Magnetic hex extension bar

EXTRA BONUS OFFER!

With every purchase of the T 2180 & T 2182 receive the T 2179 Hex Driver ***FREE****(RRP $4.15 Value)*

Keyless Chuck



This keyless chuck enables you to use PCB drill bits up to 3mm with your standard power drill.

T 2305 Normally $8.35, NOW JUST **$5**

THE FAMOUS Micron Desoldering Tool

Desolders a 14 pin IC in around 30 seconds!

The T 1280 makes it a breeze to remove components from any PCB, even double sided, through-hole plated boards. All it needs is a squeeze or two on the trigger and the component virtually falls out.

Now over 1500 units in service across Australia!

HURRY! Very limited stocks at this price!

Replacement Tips

T 1282 1.0mm Tip **$36.70**

T 1283 1.6mm Tip **$36.70**

SAVE $90!!

T 1280 Was $365, NOW **$299**

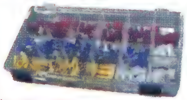
FREE! Bench stand to suit Valued at $24.20

Ratchet Crimp Tool

This professional quality crimp tool is a fantastic addition to your technical tool kit. With proper care, it will virtually last a lifetime! Suits red, blue & yellow automotive type crimp lugs.

T 1552 Was $56.70, NOW **$45**

150+ Assorted Crimp Lug Kit



H 1800 ONLY **$13.95**

10 each of 6.4,4.5,2.3 Female/Male spade, mini spade lugs, ring terminals, fork lugs, multi-point joiners, 5 each of red/blue/yellow inline cable joiners & 5 blue 6.4mm piggyback spade lugs

BONUS CRIMP LUGS!

Every T 1552 crimp tool purchased comes with the H 1800 (above right) *FREE!!*

NOT ~~Gaffer~~ Tape But Similar!

MADE IN USA

One of the handiest things on the planet!

48mm wide, 40m roll.

SAVE OVER 30%!

T 2960 Was $23.10 / Roll, NOW ONLY **$16** / Roll

Ball Bearing Drawer Sliders

SURPLUS STOCK PURCHASE!

LIMITED STOCKS!

These smooth-running ball-bearing drawer sliders measure 250mm deep when closed, and have an ≈12mm thick rail. They have holes for mounting the rail to the drawer and the surrounding housing.

ZX0055 JUST **$10** pair

WAY BELOW COST!

0-45V, 8A Bench Power Supply Kit

Be Quick, only 21 at this price!

(See SC Apr / May '98) This twin-metered bench power supply will be a great asset to the enthusiast and professional alike.

Features: • *0-45V Variable output* • *Variable current limit* • *Separate Earth Terminal* • *Individual Volt and Amp Meters* • *Constant 13.8V setting* • *Short circuit proof*

***Massive 8 Amp** current capacity and fully variable 0 to 45V DC output rails!*

K 3365 Normally $349, NOW **$229**

SAVE $120

on-line ordering: www.altronics.com.au • fax order line (08) 9328 3487

1-800 999 007 Perth (08) 9328 1599

12 months minimum warranty*

ALTRONICS

ATTENTION ENTHUSIASTS AND DEVELOPERS! SAVE A FORTUNE ON COMPONENTS!

RCA Stereo X-Tension Leads

2 x RCA Male to 2 x RCA Female, 1.5m extension lead.
P 0436 Normally $2.50 ea, NOW **2** for **$2.50**

P 0447 OFC Male to Male, 2m extension lead. Was $7.45 ea, NOW **2** for **$10**

SCOOP PURCHASE!!

These high quality chokes are PERFECT for building your own custom crossovers!

Cat No	Value	Core Type	Diam. mm	Width mm	Lo-Pass 6dB (8Ω Spkr)
LX7001	0.36mH	Iron	20	19	≈3.5kHz
LX7002	2.5mH	Iron	23	19	≈500Hz
LX7003	0.3mH	Air	38	21	≈4kHz
LX7004	1.6mH	Air	39	26	≈800Hz
LX7010	0.5mH	Air	40	25	≈2.5kHz

ALL MODELS, ONLY **$10** for 10

12V Lead Acid Batteries

Premium grade long life. Sealed lead acid batteries. **Ideally suited for security alarm panels.**

S 5075 1.3Ah Was $24.95, NOW **$19.95**
S 5080 3.3Ah Was $32.50, NOW **$24.95**
S 5090 7.2Ah Was $39.95, NOW **$34.95**

Premium Grade Batteries Save $$$ Over Our Competitors!

TV Lead

Standard 75Ω PAL TV Lead for connecting TV to VCR, or VCR/TV to Wall Socket.
P 0757 WAS $5.95 ea, NOW **$3** ea

5mm LEDs

Mixed packs of 100 Premium Grade 5mm LEDs in Red, Green Orange & Yellow.
Only **10¢** each!
Z 0002 Mixed Colours **$10** pk 100

HI-INTENSITY LEDs!

$1 EACH!

10mm LEDs with huge 1000mCd intensity.
BARGAINS IN BULK!
Z 0148 Was $1.70 ea, NOW GET **10** for **$10**

SLA Battery Charger

Charges 12V SLA batteries at 300mA maximum. Once the battery is charged, it automatically switches to trickle charge to prevent over-charging, thus prolonging battery life. LED indicator shows charging status. Ideal for use in security systems, fire alarms and more. Suits 1.2Ah to 7.2Ah batteries.
M 8520 WAS $29.95, NOW **$24.95**

35A Bridge

Rated at 400V @ 35A. Metal case and solder lug connections.
1000'S SOLD TO MANUFACTURERS EVERY YEAR!!
Z 0091 Was $5.25 Each, NOW ONLY **$3.50** ea, or **$3** ea, 10 & Up

1/2 PRICE BC548s & BC558s!

Z 1042 BC548 NPN
Z 1057 BC558 PNP
Both Were .21¢ ea,
NOW JUST **$10** pk 100

ADJUSTABLE SPANNERS

CLEAROUT!

Quality "shifters" at a bargain price! Every toolkit should have one!
T 2226 150mm Adjustable Wrench Was $12.95 ea, NOW **$7.95** ea
T 2228 200mm Adjustable Wrench Was $15.95 ea, NOW **$8.95** ea

1N4004 Diodes

HUGE discounts on general purpose rectifier diodes in bulk packs!
400V @ 1A.
Z 0109 Were .15¢ ea, NOW **$5** per 100
or buy 5 packs or more for only **$4** per 100

As little as 4¢ each!

Dual IEC Snap-In Plug & Socket

BARGAIN!

Earth pins are NOT linked on this item.
PA8330 Was $4.95 ea, NOW **$2** ea

30A Car Relay

S 4335 Was $7.30, NOW **$5** or 2 for **$8**

1A 12VDC DPDT Relay

DPDT Contact rating 1A @ 24VDC. 12VDC coil voltage.
S 4150 Was $5.20 ea, NOW **$4** ea

"Can I order products from Altronics via the Internet?"
YES! Our website is at **www.altronics.com.au**, *and has a fully featured on-line ordering facility!*

19" Rack Shelves

Mount VCRs, CD players, Tuners etc in a rack frame!

These ingenious rack shelves are ideal for mounting traditionally desk standing equipment into a 19" rack frame. Great for CD Players, tuners, amps, Videos, etc. Industrial strength black powder coat finish, includes special rear support to keep equipment in place. All 325mm deep.

	Was	NOW
H 5352 2U	$53.35	$49
H 5353 3U	$57.25	$54
H 5354 4U	$63.05	$59

Digital LCD Panel Meter

SAVE OVER 45%!!

This well designed LCD module will take care of most of your requirements of digital voltmeter displays. Easily configured by PCB links. Small, compact, reliable and comes complete with a professional finish plastic surround.
Specifications: 3.5 digits, 13mm Height • 200mV, 2, 20, 200 1000 V DC range • 10MΩ input impedance • 9V DC operation • ±0.5% (2 digit) accuracy
Q 0560 Was $38.85, NOW **$20**

Panel Mount Voltmeter

JAZZ UP YOUR POWER SUPPLY WITH ONE OF THESE!
This compact LED voltmeter module is ideal for applications requiring digital accuracy. The decimal point can be configured as desired.
Specs: **3.5 Digits** 13mm High, 200mVDC Range, 5VDC Operation, ±0.1% Accuracy
Q 0580 Was $26.25, NOW **$22** or 2 for **$40**

This panel meter can share a common ground with the voltage being measured, unlike many other panel meters on the market.

16 x 2 LCD Display

Supertwist display type, 96 inbuilt ASCII characters and 8 custom characters. Why not try interfacing it with a microcontroller?
Z 7000A Was $31.45, NOW JUST **$20**

1A Regulators

Buy in Bulk & SAVE 20% or MORE!

TO-220 Type

Z 0505 +5V	Z 0525 -5V
Z 0506 +6V	Z 0526 -6V
Z 0508 +8V	Z 0527 -8V
Z 0509 +9V	
Z 0510 +12V	Z 0528 -12V
Z 0512 +15V	Z 0530 -15V
Z 0514 +24V	Z 0532 -24V

Were $1.30 ea, NOW JUST **$1** ea, 10 & Up

MAINS TOROID

50% OFF BARGAIN!

25V + 25V 300W Toroid. 240V primary winding, twin 25V secondaries.
M 4088 Was $67.50, NOW **$32.50** ea or **2** for **$50**

20 Piece Mini Driver Bit Set

Packaged in a sturdy polycarbonate case, this set includes a screwdriver handle and 20 miniature screwdriver bits including Torx, slotted, Pozi, and hex.
T 2185 Was $26.20, NOW **$19.95**

Ideal for Computer or Communications service work!

on-line ordering www.altronics.com.au • fax order line (08) 9328 3487

Perth (08) 9328 1599 **1-800 999 007**

ALTRONICS

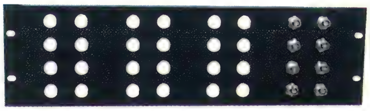
14 day money back guarantee*

"D" Connector 19" Patch Panels

Bargain prices on these 19" rack panels pre-punched to suit D9 and D25 connectors!

H 4676 16 Way DB9 1RU Sandstone
H 5176 16 Way DB9 1RU Black
Were $24.20 ea, NOW $12 ea, or 2 for $20
H 4678 16 Way DB25 2RU Sandstone
H 5178 16 Way DB25 2RU Black
Were $27.10 ea, NOW $12 ea, or 2 for $20

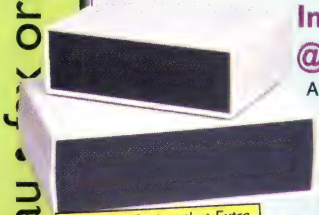
BNC Connector 3RU 19" Patch Panels



Pre-punched with 32 x 16mm holes for mounting BNC sockets. Also suits other styles of connectors!

H 4688 32 x 16mm Holes 3RU Sandstone
H 5188 32 x 16mm Holes 3RU Black
Was $28.60 ea, NOW $12 ea, or 2 for $20
H 5189 Blanking Plug to suit 16mm hole
Was .30¢ ea, NOW 10 for $2

Instrument Cases @ BARGAIN Prices!!



Give Your Project that Extra Professional Finish! At These Prices, Why Not Stock Up for Future Projects??

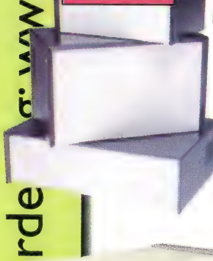
As used in many EA and SC kit projects and by many major manufactures Australia wide, these instrument cases are moulded from ABS plastic and feature internal mounting posts, PCB guide rails and ventilation slots. Attractive textured finish, with removable black front and rear panels.

Small Size 200W x 155D x 65H mm
H 0480F Light Grey Case **H 0481F** Black Case
Normally $14.65 ea,
NOW JUST $10, or 4 for $25

Large Size 250W x 190D x 80H mm
H 0482 Light Grey Case **H 0483** Black Case
Normally $18.40 ea
NOW JUST $12, or 4 for $35

K&W Project Cases

SAVE UP TO 26%!



Base is easily machined aluminium, the lid is black hammer-tone. Very sturdy cases.

H 0496 255W x 158D x 154Hmm
Was $27.25 ea, NOW $19.95 ea
H 0497 205W x 128D x 65Hmm
Was $20.95 ea, NOW $16.95 ea
H 0498 305W x 204D x 90Hmm
Was $27.25 ea, NOW $19.95 ea

Hand-Held Project Enclosure

This ABS project box is great for home-brew test equipment kits! It has 5 moulded posts for mounting a PCB, and is even supplied with two front panels: one with a 53 x 23mm cutout, and one blank. There is also a battery compartment that will accept 2 AA cells or a 9V battery. Dimensions 105W x 190D x 60H

H 0282 WAS $13.15, NOW $10

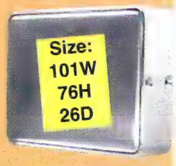
1.5A Regulated Supply

SAVE 20%! Includes Short Circuit, Thermal & Overload Protection!

Delivering a constant 1.5A at 3V,4.5V, 6V, 7.5V, 9V and 12V, the output voltage varies only minimally from full load to no load making it ideal for voltage sensitive devices like portable TV sets, video games, tape recorders, radios, scanners, computers.

M 8230 Was $47.25, NOW $35

HORWOOD PROJECT BOX


Size: 101W 76H 26D

Quality Horwood extruded enclosure. Ideal for miniaturised RF circuits eg remote controls, car audio active crossovers and other projects!

H 0456 Was $15.50 ea, NOW $7 ea

1.5A Regulated Car Adaptor

Plugs into your car's lighter socket. Includes SEVEN interchangeable tips to suit most DC applications. Fuse protected. All voltage settings except 12V are regulated 1.5, 3, 4.5, 6, 7.5, 9, 12V @1.5A.

Suitable for portable radios, TVs, CD Players, Electronic games, etc.

M 8620 WAS $31.45, NOW $24.95

MULTI-VOLTAGE PLUGPACKS

Finally, you c fit 2 plugpac into a stand dual GPO (Up to 500m excluding M 9449)

These plugpacks are in our new slimline case, which means you can install TWO of them side by side in a dual power point! They are also multi-voltage, so they can be used to power a wider variety of appliances in your home. All have an LED "On" indicator.

M 9421 3, 4.5, 6, 7.5, 9, 12VDC @ 300mA
Was $20.85, NOW $15 ea
M 9442 3, 4.5, 6, 7.5, 9, 12VDC @ 500mA
Was $25.25, NOW $18 ea
M 9444 3, 4.5, 6, 7.5, 9, 12VDC @ 1A
Was $32.95, NOW $25 ea
M 9449 1.5, 3, 4.5, 6, 9, 12VDC *REGULATED* @ 500mA
Was $31.85, NOW $25 ea

DON'T DELAY!

Stocks of some items in this sale are strictly limited! Be quick to for the biggest savings!

Quality Power Supplies @ Discount Prices!

Regulated Supplies

These regulated power supplies will deliver a constant 12V DC regardless of current drain up to 1 Amp (M 8245) and 2 Amp (M 8240). Making them perfect for voltage sensitive appliances.

M 8235 12V 1.2A
Normally $47.25, NOW $40
M 8240 12V 2A
Normally $72.45, NOW $60

13.8V DC 2A

This 2 amp rated power supply can power appliances requiring 13.8V DC at up to 2 Amps.
M 8245 Was $52.45, NOW $40

240V Timer Relays

Amazingly versatile! Build automation into your own projects

This versatile 7 day digital timer is ideal for use in any appliance which requires automation. It can be configured to switch at up to 8 different times during a 24 hour period. Switch-on and switch-off times may be set for each program. ie Allows a different "on" duration for each program. In addition, they can be programmed to operate on a wide variety of days. eg. daily, week days only, weekends only, etc. It even retains its program data in power-outs via an inbuilt long life lithium battery. **Contact Rating** 16A@30V DC (SPDT) • **Operating Voltage** 24V DC

See our 2000 catalogue page 136 for full details.

S 0050 Was $65, NOW $50

"Slot Together" Aluminium Cases

Heavy duty extruded aluminium with slide-in top and bottom aluminium panels. Includes full-length PCB slots, and the ABS end caps have provision for PCB mounting. Ideal for bench mounting equipment, especially with the optional folding legs.

H 0270 100W x 190D x 60Hmm **Was $52.50 ea**, NOW $44.95 ea
H 0271 140W x 190D x 60Hmm **Was $61.90 ea**, NOW $54.95 ea
H 0268 2 x Bench Legs $4.15 set

24VDC to 13.8VDC Converter

MASSIVE 20A CAPACITY!

Converts 24VDC to 13.8VDC for use with stereos, CB radios, two-ways etc. Suitable for vehicles fitted with 24V battery systems eg trucks, boats, tractors and some 4WDs. • Overload Protection • Rated at 20A Continuous, 25A Peak • On/Off Power Switch • Fused • Rugged and Compact • Efficiency >89%

M 8168 Was $159, NOW $139

lin orde g: www.altronics.com.au • f x order line (08) 9328 3487

1-800 999 007 Perth (08) 9328 1599

overnight delivery*

ALTRONICS

AVR DEVELOPMENT KITS!

Start experimenting with the incredibly versatile AVR micro-controllers!

(Designed by Dontronics) AVR chips are a new range of micro-controllers that boast faster operating speeds and a larger instruction set than other µ-controllers. The K 9510 is suitable for programming and prototyping projects using the 20 pin series of Atmel AVR µ-controllers. The K 9515 has been designed as a development platform which suits a wider variety of the micros, including the 8, 20 and 28 pin AVR micro-controllers. The K 9515 may also act as a mother board for the K 9510 . Each kit is supplied with a AVR micro-controller and all the necessary components to begin prototyping your first micro-controlled project immediately.

K 9510 Development Kit **WAS $34.95,** NOW $29.95

K 9515 Programming Kit **WAS $64.95,** NOW $57.95

UHF Remote Control Switch

This little gadget can easily be used to create a very simple panic alarm, remote lighting control or to control any other item you may wish to operate remotely.

Operates in 3 modes: • **On/Off** Contacts are switched alternately, •**Momentary** The contacts closed while the button is held down. • **Panic** The button must be held down for 2 seconds to operate the relays and also trip the transistor output.

Features: **• Latching/Non-latching Contacts • 2 Relay & 1 Transistor Outputs • Code Hopping • Audible confirmation • Incorporates handy key ring • 387 billion combinations • 30m operating range (open area) •24 V DC 1 Amp contacts**

Ideal for controlling your lights, garage doors, etc

A 1018 Was $115.50, NOW $99

Dual Trace CRO Card for PCs

Turn your PC into a fully functional Digital Storage Oscilloscope!

Features: Multiple cards may be used in a single PC • Wide bandwidth and high sensitivity
• Very low power consumption
• High sensitivity X-Y mode
• 20Msps per channel • Auto Setup
• Voltage Range: 50mV to 5V, 7 Steps • Time Range: 50ns/div to 0.5s/div, 1-2-5 22 Steps • 32 Kb Memory Depth
• High frequency rejection filter in the triggering circuit • Pre trigger

Note: Suitable for Windows 95/98 OS only.

Q 0148 Only $399

Digital Function & Sweep Generator

Incredibly Versatile Item of Gear; Frequency Counter, Sweep Generator and Function Generator All in ONE!

This sweep/function generator has variable sweep rate and width, and functions as a standard waveform generator with sinusoidal, triangle and square wave outputs, all with variable DC offset and symmetry. Output frequency is adjustable via a front panel dial over seven ranges. The unit also features a 2MHz bandwidth, 4 digit frequency counter with external counter input.

Q 1560 Was $625, NOW $550

SUPER BONUS! Purchase the Q 1560 Function/Sweep Generator and receive the Q 0174 CRO probe to suit, valued at $41.50 absolutely FREE!!

That's a total saving of over $100!

Opus One Hi-Fi Loudspeaker Kit

SAVE $200!
Sorry, Not available from Dealers

"They sound great with any music from classic to rock, from Mozart to Metallica."- Leo Simpson, Silicon Chip Magazine

Designed by acclaimed Australian loudspeaker designer Richard Priddle, these speakers are engineered to deliver superb sound quality whilst being incredibly simple to assemble.

This superb kit utilises a completely new construction method making construction a breeze.

Supplied in flat pack with all holes pre-machined, the cabinet and crossovers have been computer optimized to compliment the high quality drivers.The 6.5" woofers and the 1" fabric dome tweeters have been chosen for their outstanding power handling and overall performance.

FEATURES: *• No electronics expertise required. Simple step-by-step assembly instructions included. • No special tools required, all sections are pre-cut and machined. Typical assembly time 2 to 3 hours. • Fully pre-assembled 2nd order, impedance matched crossover. • Everything supplied, all you need is PVA adhesive.*

C 3300 Were $599 in 1999,

NOW ONLY $399PR plus delivery fee of $25

> "Virtually anyone can construct these speakers, whether they have wood-working skills or not. No special tools are required, although you will need a bottle of PVA glue. Once assembled, you will have a set of speakers you can really be proud of. In my opinion, these are comparable to speaker systems costing $1000 or more. **In fact, they look and sound so good, your friends will not believe you built them yourself.**"
> Leo Simpson, Silicon Chip Magazine

A6 Mahogany Finish Hi-Fi Loudspeakers

The A6 is a high acoustic output floor standing loudspeaker in graceful tower enclosure. The vented enclosure contains two high delivery 165 mm mid/ bass units and a 25 mm SUPRYNOL ferro fluid cooled dome tweeter.

OUTSTANDING PERFORMANCE!

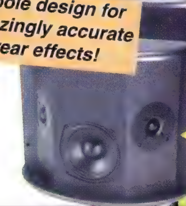
Specifications:
Frequency Response: 45Hz to 20kHz ±2dB
Crossover Point: 2.4kHz acoustical
Sensitivity: 90dB 1W at 1m
Enclosure Type: Vented Maximally Flat Butterworth 4rd Order
Dimensions: 235W x 320D x 770H mm
Power Rating: Suitable for amplifiers rated between 20 - 150W
Impedance: Nominal 6 ohms

C 5042 Were $895 pair, NOW JUST $449 pair*
*Please allow an additional $30 for road freight to anywhere in Australia.

Opus One

DS2 Dipole Surround Loudspeakers

Dipole design for amazingly accurate rear effects!



An ideal surround sound speaker for 5 channel (stereo rear effects) surround sound systems. The off-axis 25mm dome tweeters reproduce diffused mid-top effects, whilst the 130mm mid-bass driver provides fantastic rear effects fill. Fitted with polyswitch protection and acoustically damped timber cabinets with cloth grilles.
Designed and manufactured in Australia

C 5150 Were $695 pair, NOW JUST $300 pair
*Please allow an additional $25 for road freight to anywhere in Australia.

SW1 Compact Bandpass Subwoofer

Designed to complement a set of bookshelf or compact hi-fi speakers, this subwoofer will produce bass frequencies not normally heard from your stereo speakers. The dual chamber, opposing mount bandpass design produces a prodigious amount of deep, clean bass from a tiny enclosure that can fit behind a couch or unobtrusively sit in the corner of the listening room. Rated at 50W RMS, it can be operated in mono mode, or be driven by a stereo amp by removing the bridging bars from the terminals. It performs at it's optimum, however, when driven by a dedicated, active crossover-equipped amplifier.

Dual chamber bandpass enclosure for PRODIGIOUS BASS from a tiny enclosure

Frequency Response: 35Hz to 150Hz
Sensitivity: 88dB 1W at 1m
Dimensions: ≈220W x 400D x 500H
Designed and manufactured in Australia

C 5180 Was $495, NOW JUST $300
*Please allow an additional $25 for road freight to anywhere in Australia.

Want to save even more?

Buy a set of C 5042 Speakers, C 5150 Dipoles & a C 5180 Subwoofer and pay only $950

WE WILL EVEN PAY THE FREIGHT FOR YOU!

Perth (08) 9328 1599 **1-800 999 007**

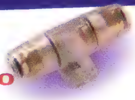
ALTRONICS

overnight delivery*

Are you ready to transform your car into a hi-performance sound machine ?

Our PRICES on hi-performance car audio accessories will blow your mind!

5AG In-Line Fuse Holder



Suits 4/8 gauge cable.

C 9780 Was $11.00, NOW $7.50

Ring & Fork Terminals

Save up to 60% on gold plated wire lug & terminals.

Fork terminals Were $1.15ea,

4G	🟥 C 9891	■ C 9894
8G	🟥 C 9884	■ C 9881
14-16G	🟥 C 9871	■ C 9874

Ring terminals Were $1.15ea,

8G	🟥 C 9844
4G	■ C 9854

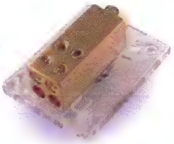
NOW 60¢ ea (in bags of 10)

Crimp terminals Were $0.80ea,

4G	🟥 6.3mm C 9801
8G	■ 6.3mm C 9804

NOW 50¢ ea (in bags of 10)

Distribution Block.

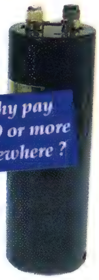


Accepts one 4 gauge input cable from your battery, and allows connection of four 8 gauge cables to feed your system components.

C 9730 Was $11.50,

NOW $7.50

1 Farad Capacitor.



Why pay $199 or more elsewhere ?

To get the best out of your subwoofer amps during heavy bass transients, you need to keep the supply rail voltage up on the amplifiers. This 1F capacitor is fitted across the supply rails of the amps and stores enough power to supply the amps during high load transients.

C 9650 Was $175, NOW $129, Or 2 for $230

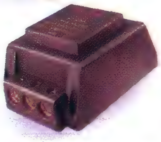
High to Low Converter.

This unit will convert speaker level output from a head unit to a low level input suitable for feeding directly into an amplifier input.

C 9620 Was $24.00,

NOW $14.95

Noise Filter.



This noise filter eliminates the ingress of noise generated by your vehicle's electrical equipment into your audio system.

C 9550 Was $83.50, NOW $59

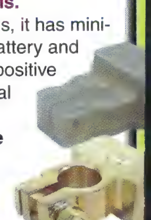
Subwoofer Crossover.

This filter connects in-line between the low level output of your head unit and the amplifier inputs. Features gold-plated RCA connectors and switchable crossover point (80Hz, 125Hz, 250Hz).

C 9610 Was $28.80,

NOW $19.95

4G Gold Plated Battery Terminals.



A must for large multi-amp systems, it has minimal contact resistance between battery and terminal. Models available to suit positive and negative terminal, with optional clear cover.

C 9700 Positive C 9703 Negative
Both Were $28.30,

NOW $15.95

C 9706 Cover Was $7.30,

NOW $3.50

Fused Distribution Blocks.

C 9770 - Three 4 gauge to four 8 gauge cables via 5AG fuse holders.

C 9770 4Way Was $36.75,

NOW $21.95

*Note: Does not include fuses.

C 9760 - One 4G to two 8G cables via 5AG fuse holders.

C 9760 2Way Was $23.05,

NOW $15

*Note: Does not include fuses.

Gold Plated Wire Lug & Wing Nut Terminal.

Mount multiple cables direct to the battery. The wire lug accepts a 4 gauge cable for connection to your battery.

C 9710 Terminal Was $12.55,

NOW $7.95

C 9720 Wire Lug Was $6.25,

NOW $4.65

12" Subwoofer

GOT BASS? SAVE 25%!

Just the shot for adding some wallop to your hi-fi, car audio, or home theatre system. This 300mm 8Ω driver has a super-rigid Poly Emulsion Coated Cone, with a high-efficiency foam surround has low-Q, low resonance and high efficiency.

Pmax: 100W RMS, **Fo:** 25Hz, **Sensitivity (1W/1m):** 92dB, **Qts:** 0.342, **Vas:** 207.8L

C 3100 Was $96, NOW $69

Polypropylene Speakers

Both employ polypropylene cones for minimal flexing and distortion. High spec hi-fi loudspeakers for component systems or replacement speakers.

Save up to 50% on spe
drivers Be quick! At th
savings the stock will nc

Sorry not available from dealers

C 3084 50W 5" Was $35 ea

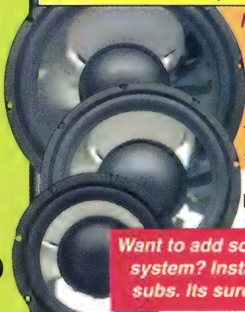
Now Just $20 ea or $30 pr

C 3086 75W 6.5" Was $45 ea

Now Just $25 ea or $40 pr

THUNDEROUS Subwoofers!

BUY ONE, GET ONE FREE!!!



Not only do these sound sensational, they look totally sexy too!!

The polypropylene cones which are mirror finished will not flex or distort under high power use. They are specially designed for small sealed or vented enclosures. Ideal for use in car, caravan, or boat sound systems.

Want to add some BIG BASS to your sound system? Install one of these sensational subs. Its sure to rattle your floorboards!

ALL DRIVERS FEATURE **MASSIVE** Double Magnets for HIGH PERFORMANCE & HUGE POWER HANDLING!!

Buy one of these fabulous subwoofers, and get another one of the same model FREE!

C 3048 200mm, 4Ω 160W	C 3050 250mm, 4Ω 200Watts	C 3052 300mm, 4Ω 250Watts
$105	$115	$155

Dome Tweeters

HALF PRICE!

These 25mm ferrofluid dome tweeters provide exceptional top end for hi-fi and home theatre speaker systems. They're just the shot for DIY speaker systems or for replacing damaged or worn out tweeters in existing speakers. 8Ω, 30W RMS.

C 3003 Were $34,

NOW $17.50 ea, or 4 for $60

6.5" TWO WAY SPLIT SYSTEM

Transform your car sound into a sensational sound experience with this fantastic Split System.

This 165mm split system enables you to mount the 6.5" mid bass driver in the door, and the dome tweeter on the dash or on top of the door trim for optimal staging. **Supplied with 2-way crossovers, mounting kit, grilles & speaker wire.**

Impedance: 4Ω, Power: **100W RMS,**
Freq. Resp: **55Hz–20kHz**

C 9302 Was $175, NOW $99

Champagne sound on a cordial budget

150W Active Sub-Woofer Amp Module

This sub-woofer will enhance your existing sound system and add a touch of realism to home theatre sound systems.

This self-contained amplifier module fits into the back of a sub-woofer cabinet. The unit will automatically spring into life from it's Standby mode once a signal is received. The Volume and Crossover Frequency Controls together with the Phase Switch allows the sub-woofer to be set for a desired sound. Installation can be completed in just minutes.

Features: • Auto Power On/Off with signal presence • Compact modular design • High and Low Level Inputs • High Level Outputs • Volume Control • Short Circuit Output Protection • Active Crossover variable from 50Hz - 150Hz • Phase Correction Switch • Power On Indicator • 240V Operation

Build your own *BOOMING* 150W Active Subwoofer!

A 2450 Was $289,

NOW ONLY $199

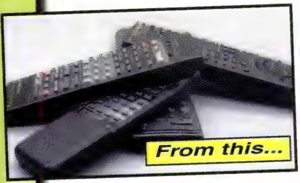
on-line ordering: www.altronics.com.au • fax order line (08) 9328 3487

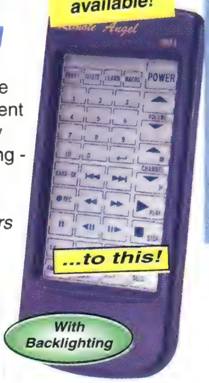
1-800 999 007 Perth (08) 9328 1599

Intelligent Programmable Remote Control

BE QUICK! Only 15pcs available!

This ***learning*** remote control can replace up to eight remote controls! *Featuring:* • 8 Different Appliance Modes • 2 Auxiliary Modes • Intelligent Backlighting - Once Activated, dims away after being idle for 5 seconds, saving batteries! *(Unlike others on the market)* Requires 4 x AAA batteries (supplied).





A 1000 Was $179
NOW ONLY
$129

Shoulder Rest

Supplied with adhesive pad to attach to telephone handset. One size fits all.

Constantly on the phone?

P 7000 NOW **$7** ea

Inline Surge Protector

CHEAP INSURANCE! Guard your valuable equipment with these surge protectors!

These compact inline devices will provide clean power to your valuable appliances. All models include thermal overload protection guaranteeing safe operation of your equipment.

P 8180 IEC (Includes audible buzzer) - Suits PC's, Fax Machines, etc. ONLY **$39**

P 8182 Fig '8' - Suits most Laptops, Portable Hi-Fi, Videos, etc. ONLY **$29**

P 8184 'Cloverleaf' - Suits IBM, Dell and Apple Mac laptop computers. ONLY **$39**

4 Way Telephone Switcher

Switches either 4 telephone lines to one device or 4 devices to one line!

Very easy to use, just plug in the items and dial up the required device/line and you are away!

P 7018 ONLY **$65**

STOP JUGGLING THOSE PLUGS! *Plug them in to this and just turn the dial!*

Slimline Telephone

This easy to use slimline telephone is perfect as a second phone for the bedroom, office or kitchen.

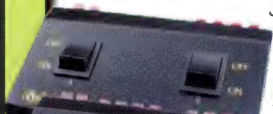
Features: Ringer On/Off switch (bedroom use) • Tone/Pulse dial switch • Last number redial • Wall or desk mounting base

Supplied complete with a RJ12 to AUS Adaptor

(Note: Telephone must be fitted by an authorised technician)

P 7012 **$29.50**

2 & 4-Way Speaker Switchboxes

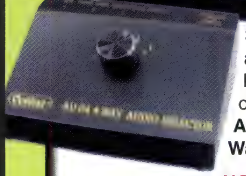


Just the trick if you are thinking of adding some speakers in another location. ie. patio, family room, etc.

A 3020 2-Way Was $24.95,
NOW **$19.95**

A 3025 4-Way Was $34.95,
NOW **$24.95**

Line Input Switch



Switches 4 stereo line inputs to a single amplifier line input. Basically, it expands the number of line inputs on your amplifier.

A 3035 4-Way Line Switch
Was $22.95,
NOW **$19.95**

2 Channel FM Wireless Intercom

This compact intercom system allows you to install a full function intercom system in your home without installing any cables. Simply plug them into the power point and you are in business! Features: 2 Channels • In Use indicator • PTT operation or "Talk Lock" operation (for use as baby monitor) • Call button • • 240V operation

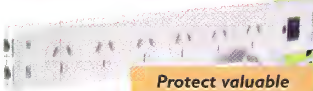
P 7002 ONLY **$99**

NO FIXED WIRING REQUIRED

Perfect for anyone living in a rental property!

Surge Protection Boards

Power surges lasting just a fraction of a second can destroy valuable electrical equipment. The P 8140 and P 8150 6 way boards include surge and RF EMI protection. The P 8150 includes line protection for telephone equipment such as faxes, modems and answering machines.



Protect valuable electrical equipment from destructive power surges!

P 8140 6 Way Board, **WAS $37.75,**
NOW ONLY **$29.95**

P 8150 6 Way w/Phone Protection **WAS $47.20**
NOW ONLY **$39.95**

Cable Ties

Buy in bulk and save HEAPS!

PACKS OF 1000

H 4014 100mm
$9.85 Per Pack

H 4024 200mm **$32.45** Per Pack

Professional Adjustable Holesaw

The quick, easy and clean way to cut precise holes into almost any surface!

Featuring an adjustable cutting tool and impact-resistant transparent cowling, this cutter is very simple to operate. The spring loaded cutting tool ensures the cowling remains in place to ensure complete safety at all times. Cutting depth of up to 23mm thick may be achieved by a single cut or alternatively a maximum of 45mm is possible by drilling from the opposite side. Perfect for cutting holes in Plasterboard, Plywood, Acrylic sheet, etc. (Not recommended for cutting metal)

Cuts precise holes from a tiny 30mm to a whopping 203mm the clean and easy way!

T 2316 WAS $210.00,
NOW **$170**

Complete Package Contains:
1 x Spare cutter blade (T 2318) • 1 x Transparent Cowl • 1 x Combination 6mm Drill / Arbor • 1 x Allen Key • 1 x Adjustment tool • 4 x Balance bars • 1 x Internal assembly • 1 x Carry Case

Pre-Programmed Remote Control

FOUR-IN-ONE!!

Lost or damaged your original remote?

Pre-programmed codes to suit all popular makes of Televisions, VCRs and CATV, this is the answer. It also combines the functions of your TV, VCR and CATV into just one unit. Simple to setup!

Don't spend $100's on an original remote when you can have all the same functions for a fraction of the cost!

A 1005 WAS $48,
NOW **$28**

SAVE 40%!!

ANR Aviation Headset

The last word in affordable professional headsets. The ALL NEW C 9069 is built to last a lifetime!

Features: • Extra thick ventilated headpad • Corrosion proof steel frame • Soft gel filled polyurethane ear pads • Earphones wired in parallel for safety and reliability • Compatible with 150-1000 ohm systems • Adjustable volume control • Universal boom microphone, can be placed on left or right • High performance noise cancellation • Electret microphone

C 9069 Was $550,
NOW **$440**

Over 10,000 Altronics headsets are now in use throughout Australia, NZ and PNG!

FREE!!
Every C 9069 purchased includes a C 9075A Carry Case (RRP Valued $24.75)

Attention Motor Racers! The C 9069 makes a perfect pit-crew headset!

ALL NEW ANR Model

ANR (Active Noise Reduction) circuitry cancels unwanted external noise. ie. cockpit engine noise. The C 9069 attenuates ambient noise by around 18dB. In addition, All Altronics headsets are Nata Certified & Accredited with an SCL80 Rating of 29. This is significantly better than other brand name headsets which only boast a modest 23-26 rating.

ALTRONICS

14 day money back guarantee*

240V Plug-In NiCad/Ni-Mh Battery Charger

Charge your batteries in less than 8 hours with this versatile charger! Charge either 2 (5hrs charging time) or 4 (7hrs charging time) AA batteries at a time.

SAVE 42%!

A 0285 Was $17.50

NOW ONLY $10

AA NiMH Batteries

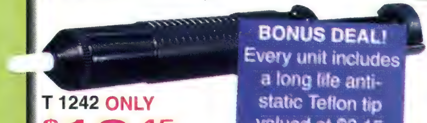
S 4745 1300mAh

Was $6.25 ea,

NOW $4.50 ea, 4 up or $3 ea, 10 up

Solder Sucker Tool

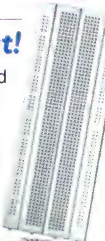
The easy way to remove components from a PCB quickly and without damage to the board or component.



BONUS DEAL! Every unit includes a long life anti-static Teflon tip valued at $3.15

T 1242 ONLY $10.45

Customer Backs Out!

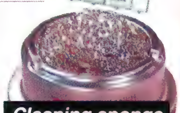


A customer has recently cancelled a huge order of these 840 way breadboards so here is your chance to snap up a bargain!

P 1009 ONLY $10

WAS $17.35

Soldering Iron Tip Cleaner



This ***DRY*** tip cleaner is just the trick!

Cleaning sponge dry again?

T 1330 ONLY $10

BASIC STAMP® Development Kit

An ideal Launch platform for anyone interested in developing Microcontroller based projects!

Includes a 463 page manual covering all Stamp® modules, programming cables for both Serial and Parallel, software, etc.

Z 5530 ONLY $149

120A Jumper Leads

Keep some in the boot for emergencies! These jumper leads have a huge 120A current capacity, and come with super heavy duty alligator clips for a firm connection to the battery.

ZX0045 A CRAZY $15.95

LARGE SCREEN LCR DMM

An extremely versatile DMM ideal for engineers and technicians!

This fully featured LCR meter can measure capacitance and inductance measurements, as well as having a huge range of the usual DMM features. It also has a 20MHz frequency counter! • Peak & Data Hold • Auto Power Off • Temperature measurement • Peak/Min/Max Display • Backlit Display • ACV to 750V • DCV to 1000V • ACA & DCA to 10A • Resistance to 2000MΩ • Capacitance to 200μF • Inductance to 20H • Logic Test • Transistor Test • Continuity Buzzer • Temperature -40°C to 1000°C

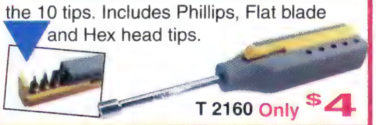
See our 2000 Catalogue p74 for full specs.

Q 1084 Normally $149,

INTRODUCTORY PRICE $129

10 Pce Driver & Bit Set

Clever design incorporates slide out draw which forms part of the handle. This holds the 10 tips. Includes Phillips, Flat blade and Hex head tips.



T 2160 Only $4

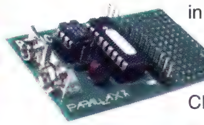
Stamp® 1 Micro Controllers

All Stamp1 modules *Feature* • PBASIC instruction set • 8 I/O lines • 256 bytes of EEPROM storage area • Can handle up to 80 instructions • Programming is achieved via the standard Parallel port of a PC running DOS. • Powered by a 9V DC supply • Clock speed of 4 MHz. The Z 5500 Stamp 1D incorporates the Z 5505 carrier board whilst the Z 5507 is a more compact version of the Stamp 1 used for final production runs.

Z 5500 ONLY $89

Z 5507 ONLY $89

Z 5505 ONLY $45



120W Gas Soldering Iron

The ***"Big Gun"*** in cordless soldering!

Reliable piezo ignition will ensure this iron lights every time, with a whopping big heating capacity of up to 120W this iron suits just about any job!

T 2600 Was $105.00

NOW $89

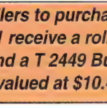
WHY PAY $200 OR MORE for a 17cc tank size when you can have a 33cc for only $89!

7 in 1 • 120W Iron Kit

The T 2601 kit comprises of the T 2600 Gas Soldering Iron PLUS a handy carry case with a range of tips and accessories including cleaning sponge, solder dispenser, blow torch, hot air blower and hot knife cutter.

MASSIVE 120W Heat capacity! Simple "thumb-start" piezo ignition refillable gas storage!

T 2601 Was $155.00 NOW $129



The first 100 callers to purchase a T 2600 or T 2601 receive a roll of T 1100 solder and a T 2449 Butane Refill, together valued at $10.45 FREE!

Cooling Fans

Fantastic computer type fans for replacement or additions for extra cooling of power supplies, amps etc. Keep your cool with these quality fans at discounted prices!

	Was	NOW
F 1020 240V 80mm	$28.90	$16
F 1030 240V 120mm	$28.90	$16
FA1030 240V 120mm + leads	$27.95	$15
F 1050 12V DC 80mm	$16.75	$10
F 1060 24V DC 120mm	$28.90	$16
F 1022 80mm Finger Guard		$2.55
F 1032 120mm Finger Guard		$3.30

SAVE up to 45% on FANS!

Stamp® 2 Micro Controllers

Features: PBASIC instruction set • 16 I/O lines • 2048 bytes of EEPROM storage • Can handle up to 500 instructions. • 24 pin DIL configuration •Programmed via the standard Serial port of a PC running DOS • Requires 9V DC supply • 20MHz clock speed

Z 5520 Stamp 2 Module ONLY $119

Z 5522 Stamp 2 Programming & Development PCB ONLY $45

P 1770 Programming Lead suit Stamp 2 ONLY $8.35

Programming & Customising the BASIC Stamp® computer

An excellent reference for anyone interested in the principles and applications of the BASIC stamp controller. Illustrated with clear explanations and some examples of projects to try. Includes compiler on CD. 284 pages.

B 2455 ONLY $84.70

ALTRONICS

174 Roe St. Perth W.A. 6000
Phone (08) 9328 1599, **Fax** (08) 9328 3487
MAIL ORDERS C/- P.O. Box 8350
Perth Business Centre, W.A. 6849

****No Risk 14 Day Money Back Guarantee:** If you are dissatisfied with our goods for any reason, please return to our premises within 14 days of our despatch date and we will refund your purchase in full, less transport costs. All items must in *NEW* condition.

*****1 year minimum warranty:** 12 months from date of supply. Goods becoming faulty in this period should be returned to our premises with evidence of purchase and $6 money order, cheque or stamps to cover return postage.

Standard Delivery & Packing Charge: $5.50 to 500gms, $6.60 500gms-1 kg, $9.90 1kg-5kg. Where possible we process your order the day received and despatch via Australia Post. Allow approx 9 days from day you post order to when you receive goods.

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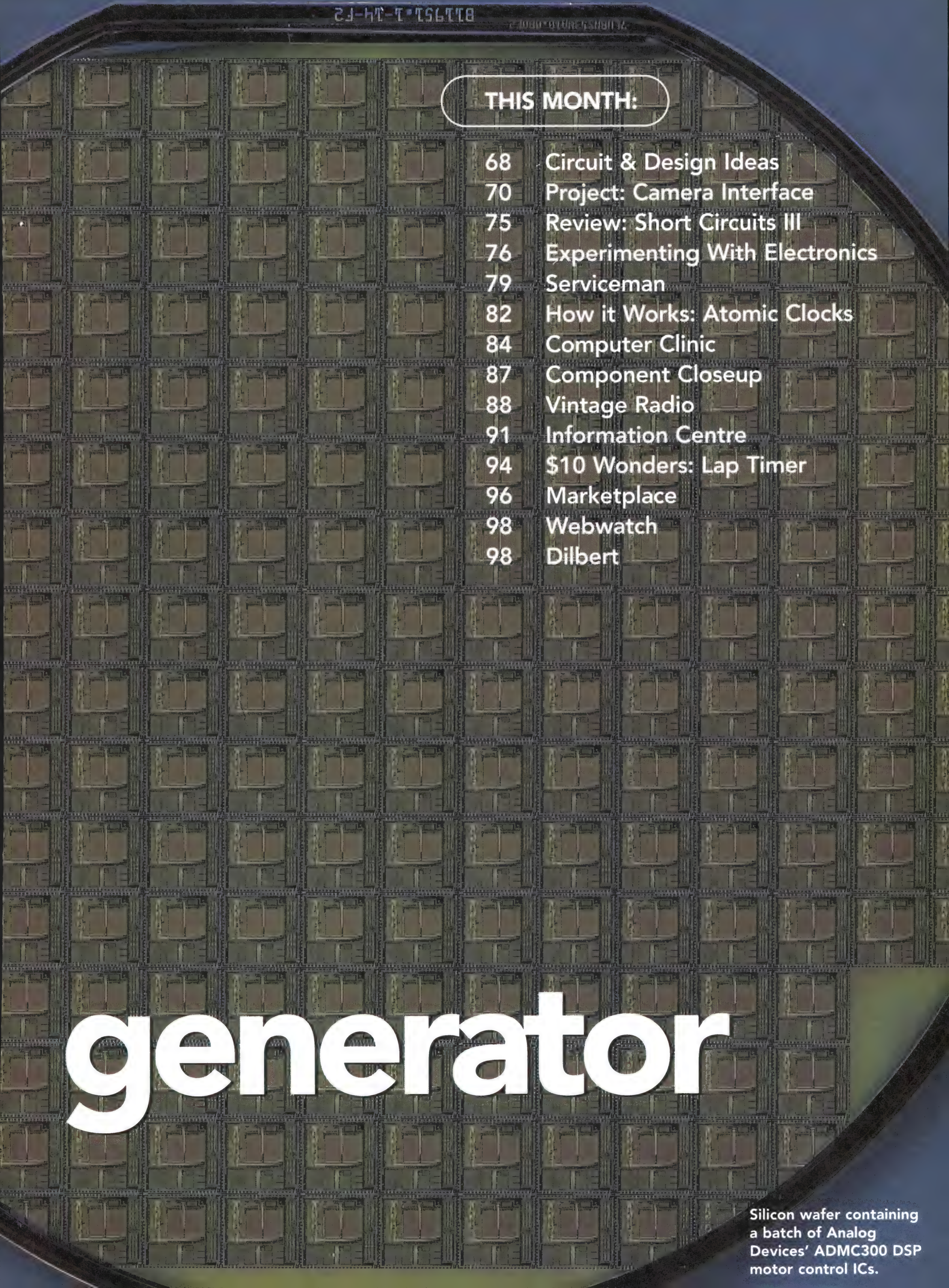
Silicon wafer containing a batch of Analog Devices' ADMC300 DSP motor control ICs.

generator

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Slave power switch

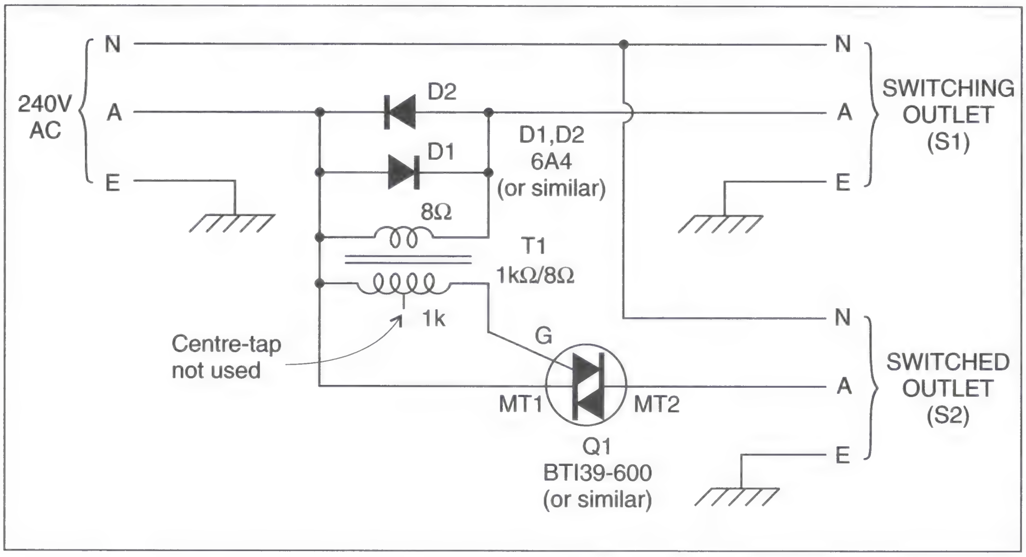
WHILE RENOVATING the ceiling of my bathroom, I found it rather difficult juggling a sander, vacuum cleaner and a wife requiring constant progress reports. To (at least partly) alleviate the problem, I made a slave switch for the vacuum cleaner so it would switch on with the sander.

When the sander is operating there is approximately 0.8V developed across the diodes, which is transformed up to drive the triac, and this in turn switches the vacuum. The unit as shown has done about 3 weeks of hard work with a 200W sander and a Sanyo vacuum cleaner, but the same principle can be adapted to larger loads by using the appropriate diodes and triac.

If necessary the triac can operate a relay or contactor for heavier single or three phase loads (commercial dust extractors, etc), and I have previously used the diode/transformer circuit for phase failure protection on 3-phase lighting and power plants.

The construction is simple enough, but extra care must be taken with safety aspects such as the earthing and circuit board mounting.

Roy Wallace
Mornington, Vic ***$40***



ea Circuit and Design Ideas entry form

Use this form when sending in your Circuit and Design Idea (CDI) submissions and you'll stand the best chance of your entry being chosen, or better still, selected as our 'Idea of the month' prize winner!

Remember, this is also a forum for reader's design ideas, so the entry doesn't necessarily have to include a schematic diagram, or even be based on a circuit. So if you have an interesting electronics-related design or idea, send it in - you could have your contribution published, and profit from it too!

Send to: ***Circuit and Design Ideas Editor, Electronics Australia, PO Box 199, Alexandria NSW 1435;*** or Fax to: ***(02) 9353 0613***

Attached is my Circuit and Design Ideas submission.

Name . . . .
Address . . . . Postcode/ZIP . . . .
Country . . . . Phone . . . .
Email . . . .
CDI submission title . . . . Date of submission . . . .

While we will certainly consider CDI entries that do not include this form, we strongly encourage readers to fill in the above information and send it along with their submission. It helps our filing system so we're less likely to loose your entry, and it makes sure that you include essential information such as your postal address - we can't send you a prize if we don't have that!

If you don't wish to cut up your magazine, make a photocopy of this page and fill that in, or just include the above details on a separate sheet of paper. Emailed CDI submissions should also include your details, preferably laid out as above.

CDI entries must be original, not previously published, and not concurrently submitted to other magazines. We consider all CDI entries, but cannot guarantee that yours will be selected for publication. **ea**

Interesting original circuit ideas and design tips from readers. While this material has been checked as far as possible for feasibility, the circuits have not been built and tested by us. We therefore cannot accept responsibility, enter into correspondence or provide any further information.

THIS MONTH'S WINNER!

Do Not Disturb Timer

HERE IS A simple circuit that disconnects the phone for a defined period of time. You can easily change the 'phone off' period from a few minutes to a few hours, and if you place this timer between the answering machine and the phone, the 'machine' can always take a message.

The circuit is based on a 555 timer configured in the monostable mode. The time delay is set by the RC network of R3 and C1. The main advantage of this circuit is that when it times out the power to the circuit is completely turned off, in order to preserve battery life. The relay used to switch the telephone line is a DPDT type relay.

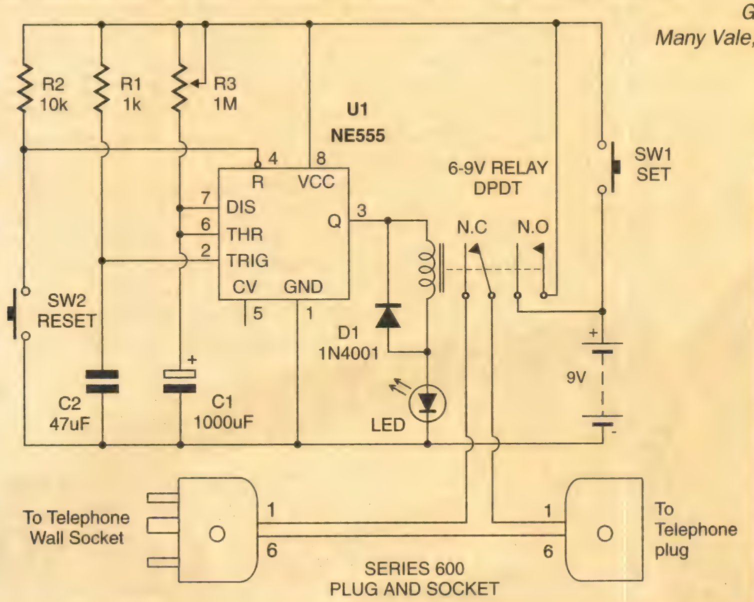
The telephone line is connected to the normally closed contacts of one of the poles on the relay, so when the timer is off you have a normal phone connection. The normally open contacts of the other pole of the relay are used to switch the power to the circuit.

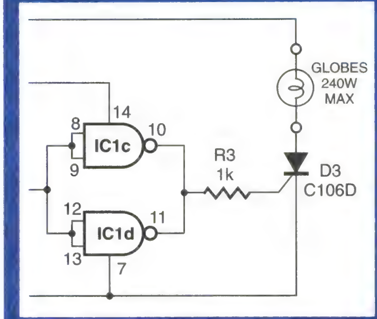
When SW1 (SET) is pressed the normally open contacts of the relay are bypassed via the switch, and power is applied to the circuit. The RC network consisting of R1 and C2 provide the trigger pulse for the 555 timer at power-on, and this turns on the output of the timer and energizes the relay. The relay contacts then provide continuous power to the circuit from the battery, while at the same time the other relay pole (NC contacts) disconnect the phone line. When the timer times out, its output turns off the relay, turning the power off again and the phone back on.

SW2 (RESET) is connected to the 555's reset pin. If the timer is in its timing period, pressing SW2 will turn off the timer immediately forcing the output of the timer low, turning off the relay and your phone back on.

The relay coil should be about 500 Ohms and rated around 6-9V. An LED is placed in series with the coil and lights when the coil is energized, telling you that the timer is on. With the parts shown the circuit draws about 20mA when on. Happy Napping!

George Katz
*Many Vale, NSW **$30***





Not so flashy

PLEASE NOTE that the 'Globes flasher for the festive season' submission in the September issue has an error in the schematic (page 68). The globes are shown wired in series with the SCR's cathode, but should in fact be connected on the anode side of the SCR as depicted in the revised circuit shown here. Our thanks to the ever-vigilant Phil Allison for pointing this out.

Win our 'IDEA OF THE MONTH' Prize!

Valued at $469!

As an added incentive for readers to contribute interesting ideas to this column, the idea we judge most interesting each month now wins its contributor an exciting prize, in addition to the usual fee. The prize is a Video Inspection Capture System from Allthings Sales & Services, which consists of a colour CCD camera, close-up lens set, adjustable stand and lamp, PCI video capture card and software, plus video cable and two plugpacks. You can find out more about this great system at the Allthings website; www.allthings.com.au.

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BY JIM ROWE

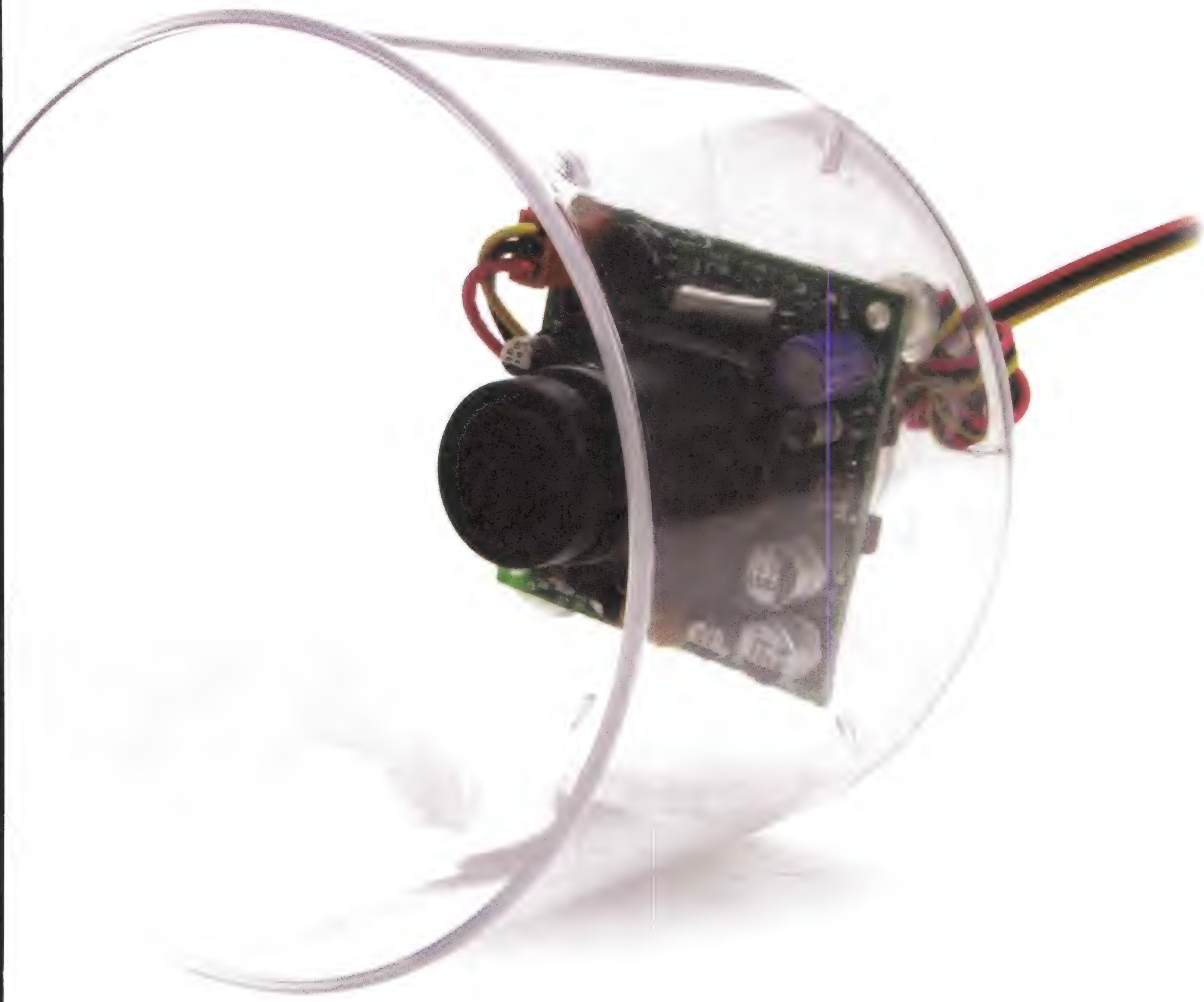
Supply/Interface for **CCD Cameras**

Low cost CCD video camera modules are now widely available, and can be used for all kinds of things in the home or office. But in most cases you'll need to provide them with a suitable power supply, and probably also hook them up to an RF modulator so the picture can be viewed on a standard TV set. Here's the design for an interface circuit which suits these jobs very neatly -- and even provides a simple audio amp for situations where you need to hear what's going on as well.

THERE HAVE ALWAYS been many worthwhile uses for video cameras, but a lot of them were a bit impractical while the cameras remained fairly bulky, expensive and fiddly to adjust. It's only with the availability of CCD camera modules in very compact and low cost form (and essentially 'automatic' in operation) that many of the applications have become a practical proposition.

Take baby minding, for example, or front door monitoring. In both these cases, there's always been a big advantage being able to *see* what's happening in baby's cot, or who's actually at the front door. But when video cameras were quite expensive, most people had to settle for an audio link and simply hope that the sounds they could hear would give them enough information.

An even better example is reading assistance, for people who have a visual impairment. A video camera and monitor/TV screen combination can make reading significantly easier for people with certain kinds of limited eyesight, yet the cost of providing such a setup previously made it



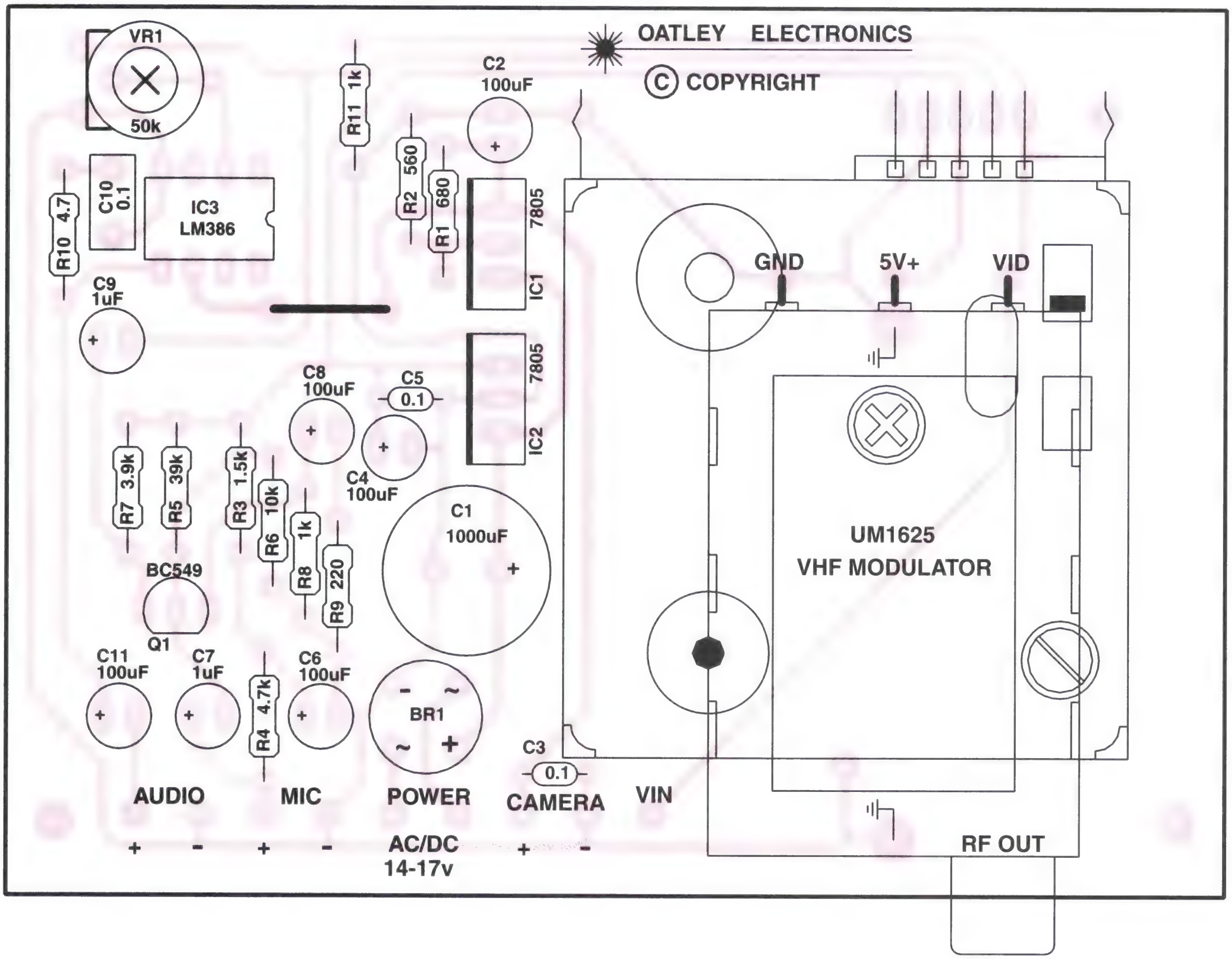
beyond the reach of many such people. This is where low cost CCD camera modules have really been able to help.

Mind you, although the modules integrate just about all of the circuitry for a complete video camera onto a single tiny chip or PC board, they still need to be provided with a suitable power supply. And since they generally only provide a composite video output, you still need to feed this through an RF modulator if you want to see the images on many standard or low-cost TV receivers.

As quite a few people have found, there are also some pitfalls for the unwary. Since the cameras are usually specified for a nominal DC operating voltage of 12V, for example, many people have hooked them up to a nominal 12V DC plug-pack supply – only to find that the camera works for a very short time and then 'goes dead'. That's because most such plug packs are unregulated, and with the relatively small load current drawn by a camera module, their output voltage can rise as high as 17-18V.

Although most camera modules *do* include a supply voltage regulator on board, it's generally a tiny 'chip' device with a very low power dissipation rating. When fed with input voltages higher than about 14V, typically, it's very likely to overheat and be permanently damaged. So for reliable camera operation, unregulated plug packs by themselves are a no-no; in fact a regulated supply of 11-12V DC is best.

On the other hand if you want to use a small RF modulator with the camera, many of the modulator modules are designed to oper-



ate from a regulated 5V DC supply and won't work for long if you feed them with a much higher voltage. You therefore tend to need a regulated 5V supply for the modulator, as well as the higher voltage supply for the camera.

It's all a bit more complicated than you might have wished, then, but providing you tackle things correctly, getting one of these cameras up and running really isn't that difficult. Especially if you take advantage of the little interface unit shown, which has been developed by the team at Oatley Electronics especially to help people wanting to use CCD camera modules with the least hassle.

Basically it provides a neat way to ensure that the camera and modulator are fed with their correct power supply voltages, using almost any source of 14-17V AC or unregulated DC – which you can get from a wide range of small transformers or plug packs. There's even provision on the interface board to mount either of two common types of RF modulator, to make this aspect easier too.

In addition, Oatley's designer has provided for all of the components of a small audio amplifier to be mounted on the board, so it's really easy to provide your video monitoring system with an audio link as well. The amplifier uses only a transistor and single IC, with a handful of other parts, but provides sufficient gain to take the signal from a standard electret mic insert and drive a small speaker. Which is all you need for basic audio monitoring, of course.

Everything fits on a small PC board apart from the camera module itself, the mic insert and speaker. So if you've been wanting to set up a reading aid, a baby minder or a door monitor with one of these cameras, this project should allow you to do it very easily and neatly.

By the way kits for the interface are available from Oatley Electronics, as K163. The kits include a VHF modulator, an electret microphone insert, a small speaker and even a plastic weatherproof case, and are priced at only $18. Oatley can also supply CCD camera modules as well, and at competitive prices. They can also supply suitable plug packs, and an alternative UHF modulator if you prefer it.

How it works

The 'raw' input from your transformer or unregulated plug pack supply is first passed through diode bridge BR1, which automatically rectifies the input if it's AC, or ensures the correct polarity if it's DC. Capacitor C1 then applies a reasonable amount of smoothing, after which the unregulated DC is fed to the two voltage regulator circuits – both using standard 7805 chips.

Regulator IC1 is used with a 'bootstrap' voltage divider (R1/R2), so that it delivers an output of very close to 11V. This is very close to the optimum voltage for most camera modules, so IC1 is used to supply both the camera and the audio amp output chip IC3. Capacitors C2 and C3 bypass the +11V line and make sure that there's no interaction between the camera and amplifier circuitry.

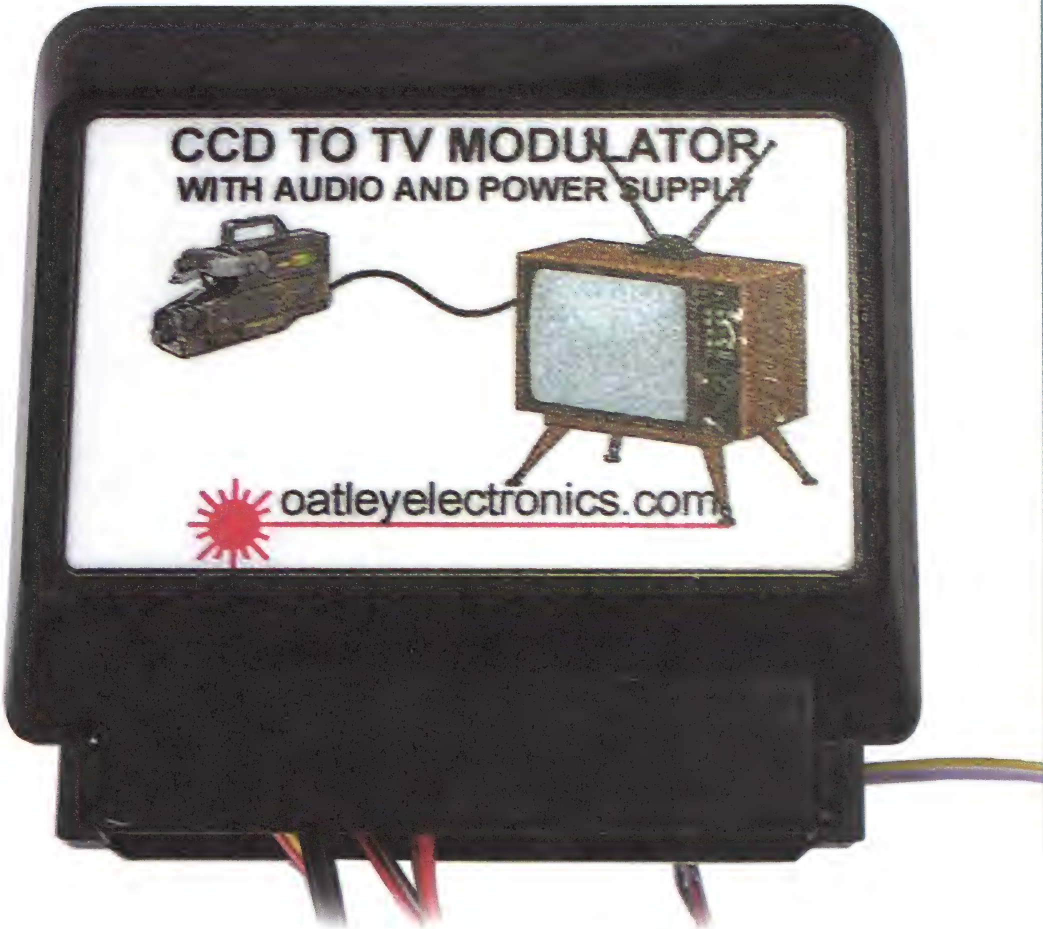
The second regulator IC2 is used 'straight' to deliver a +5V rail, which in this case feeds both the RF modulator and the first stage of the audio amplifier – including the electret microphone, as you can see. Again bypass capacitors C4 and C5 are used to ensure there's no interaction between the two circuits.

The only connection to the CCD camera, apart from those for +11V and ground, is that used to take its video output to the corresponding input of the RF modulator. Shunt resistor R11 provides a DC return path to ground, as this is needed by some modulators.

The audio amplifier circuitry is also quite straightforward. Resistor R3 and capacitor C6 provide additional decoupling for the electret mic supply voltage, to ensure stability. R4 is the mic load resistor, while C7 couples the mic output signal to the base of Q1, which acts as a common-emitter preamplifier stage.

The voltage gain of the preamp stage is set to about 17 by the ratio of collector load resistor R7 to the effective emitter feedback resistance – R9 in parallel with R8. This allows the gain of the stage to be easily varied if you really need to, simply by changing the value of R9. Lowering its value will increase the gain, and vice-versa.

The output of the preamp is coupled via C9 to VR1, which acts as a simple volume control feeding IC3 as an output stage. IC3 is a standard low-cost LM386 chip, with its output coupled to the speaker via C11 and R10/C10 connected as a Zobel network across the output to ensure stability.



PARTS LIST

resistors

R1	680 ohms
R2	560 ohms
R3	1.5k
R4	4.7k
R5	39k
R6	10k
R7	3.9k
R8,11	1k
R9	220 ohms
R10	4.7 ohms
VR1	50k horiz trimpot

capacitors

C1	1000uF RB electrolytic
C2,4,6,8,11	100uF RB electrolytic
C3,5,10	0.1uF greencap or MKT
C7,9	1uF RB electrolytic

semiconductors

IC1,2	7805 regulator
IC3	LM386 audio amplifier
Q1	BC549 NPN low noise
BR1	W04 diode bridge

miscellaneous

PC board, 96 x 67mm; 8-pin DIL socket, for IC3; RF modulator, as desired; electret mic insert; small speaker; hookup wire, solder etc.

NOTE: Copyright for the PCB used in this project is held by Oatley Electronics, and boards will not be available elsewhere. However kits for the project are available from Oatley, along with other parts which are suitable for use with it:

K163 kit (includes PCB and all on-board parts, VHF modulator, electret mic, speaker and plastic case)	$18
K163 kit with CA41L92 CCD camera	$95
Suitable plugpack supply	$9
Alternative UHF AV modulator	$18

Orders should be sent to Oatley Electronics, PO Box 89, Oatley 2223,
or phone (02) 9584 3563 or fax (02) 9584 3561.

Assembling it

As you can see from the photo, most of the parts for the interface fit on a small PC board measuring 96 x 67mm. There's even room on the board for two different types of RF modulator module – one of the larger video and audio balanced-modulator UHF types with a built-in antenna booster, or one of the smaller video-only VHF types.

The only parts which don't fit directly on the board are the electret microphone, the speaker, the CCD camera module and the 14-17V unregulated power supply.

As usual, the best way to begin assembly of the board is by fitting the low profile parts first: in this case the single wire link (between IC3 and IC1) and the various resistors. Then you can fit the socket for IC3, followed by the small capacitors and the larger electrolytics (being careful with polarity).

With these parts fitted you would then fit pot VR1, diode bridge BR1 (again being very careful with polarity), transistor Q1 and the two 7805 regulators. Note that both regulators are fitted to the board with their heatsink tabs facing toward IC3 and Q1, and away from the RF modulator.

Now by fitting the RF modulator of your choice and plugging in IC3, your interface should be complete apart from running the connections to the various off-board parts. As you can see from the PCB overlay, all of the connections to the off-board parts are along one of the longer sides of the board for convenience.

Troubleshooting

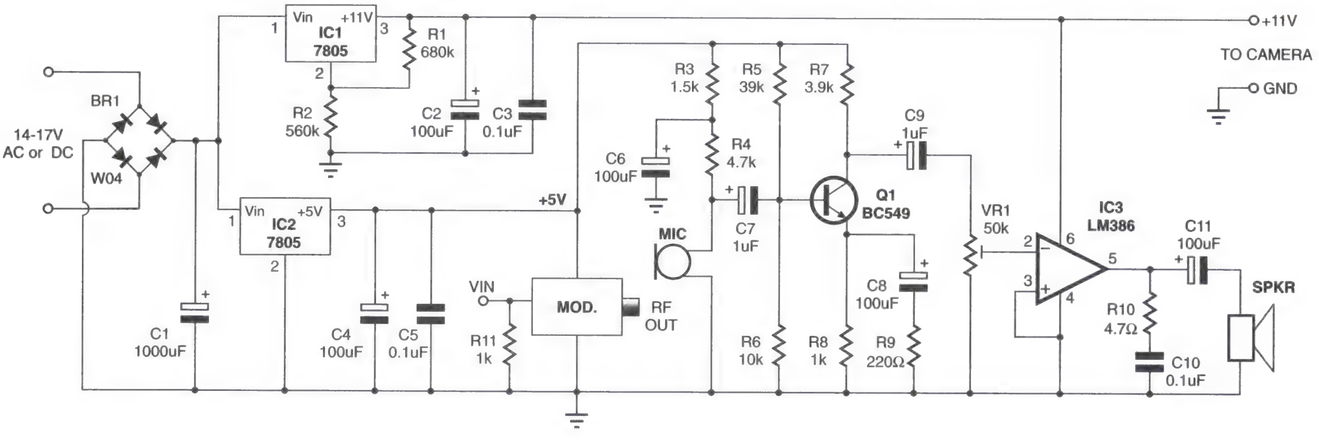
The circuit of the interface unit is so straightforward that there's very little risk of any problems. You should be able to connect everything up, apply the power and then simply tune your TV to the modulator's output channel, in order to see the camera's output.

If you *can't* find the signal, grab your DMM and carry out some quick troubleshooting. For example measure the output from the 5V regulator – say at the centremost of the RF modulator connection pins. Is there +5V present? There should be, and probably will be unless you've fitted IC2, BR1, C1 or C4 incorrectly. So if there's no +5V, switch off and look for your wiring mistake...

Similarly measure the output from the +11V regulator, say at the wire link near IC3. If the voltage is correct, fine; otherwise switch off and look for a mistake in the wiring of IC1, IC3, C2, R1, R2 or perhaps even C9 or C11.

The odds are, though, that providing you've been careful in fitting each of the parts, and have made no accidental short circuits while soldering, your interface unit will deliver the camera's signal right where you expect it to be on the TV set's channel tuning. Using the camera as a baby monitor or door minder, reading aid or whatever should now be very easy. But the fine details of that are left to you! **ea**

__The circuit__ is really little more than a couple of power supplies, an audio amplifier, and a video modulator. Two supplies are used, as the camera runs best off 11V, while the modulator and amp require 5VDC.



Short Circuit to learning

Just starting out in electronics, or know someone who is? The latest project book from Jaycar Electronics will give you a helping hand into the heady world of building your own projects. **by Graham Cattley**

I WELL REMEMBER well the first electronic project I ever built. It was a two transistor AM transmitter, and was constructed on a short length of 2 x 4, using tag trips. The design came from an old 1960s American '101 Transistor Circuits' book, and after weeks of tracking down the components, winding the coils and soldering it all together, I finally switched it on.

It didn't work. Nothing. Dead.

I traced out the circuit, and could find nothing wrong, so it ended up in the corner collecting dust while I explored other avenues of interest to a nine-year-old boy — mainly constructing model aeroplanes.

Fortunately, someone told me to take apart my failed transmitter and build a crystal set with the parts instead; it worked first go. My faith (and interest) in electronics was restored.

I am recounting this rather boring tale to illustrate a point. If you are new to electronics, then you need a lot more than a simple schematic and three paragraphs of text to get a circuit up and running. You need instruction on soldering, information on those weird capacitor codes, and some guidance on using a multimeter.

You also need some good, interesting projects to build, because after all, that's the whole point of the exercise.

BONUS!
Soldering: how it's done
Project 8
Light Chaser
Everyone has seen a chaser, where lights are turned on and off in such a way as to make them appear to "chase" each other. They're very popular in shops, theatres and advertising displays. Here's one you can make yourself!
What does it do?
Construction
You will need these parts

Short Circuits

Well, as you might have expected, this is exactly what I found in Jaycar Electronics' *Short Circuits, Volume III*. It takes over from the rather basic *Short Circuits, Volume I* released a couple of years back, and contains over 30 practical, interesting and entertaining projects using common off the shelf components.

As well as the projects, there are some good tutorials on how to solder, how to use a multimeter and one even reading those capacitor codes — what more could you want?

Very little, actually. The projects are well designed, and the applications well thought out — you'll find a number of items here that you'll want to get stuck into right away. All the designs are constructed on PCBs (as opposed to the plastic baseboard used in Volume 1), and are all pitched at much the same level of complexity. This means that you can jump right in and build the Electronic Bongos, or Guitar Waa-Waa, or whatever; you don't have to start at project one and work your way through the book.

This fact highlights the difference between *Short Circuits* and other 'beginners' level books; it isn't so much a tutorial or step by step 'plug component A into hole B' type of guide, but instead a collection of well laid out projects with easy to follow instructions.

At this point I should make mention of the production quality — it's excellent. Large clear drawings and appealing photos make construction straightforward, to say the least. This, and nice clear headings such as 'What does it do' and 'What to do next' make it easy to digest the instructions before, during and after construction. In an effort to make each project simple to follow, the main text covers the construction, testing and follow-up, with a separate how-it-works 'Tech Talk' box, where the circuit's operation is explained in detail.

Easy as 1, 2, 3

So, to boil it all down into one statement: I'm impressed. A lot of work has obviously gone into producing *Short Circuits, Volume III*, but there's just one thing that puzzles me: what happened to Volume II?

Perhaps because Volume I was aimed and the complete novice, Jaycar thought that this latest effort was too advanced to be a Volume II. Maybe we'll see a Volume II sometime in the future, covering the intermediate stages.

This sort of numbering system was good enough for George Lucas I suppose, so with any luck we'll see the third part of this trilogy sometime soon. If it is anywhere near half as good as volume III, the wait will be worth it. **ea**

SUMMARY

- ■ A collection of over 30 easy to build electronic projects, along with tutorials on using multimeters, soldering and other necessary electronic information, presented in a large format 130 page soft cover book.

PROS

- ■ An excellent collection of projects.
- ■ Good clear construction details.
- ■ Great photos of the projects.

CONS

- ■ The typeface chosen is a little hard to follow at times.

RRP

- ■ $24.95

AVAILABLE

- ■ All Jaycar Electronics stores, Australia wide.

DARREN YATES

Transistors – 4:
Power amplifiers

Darren Yates continues on from last month with a look at transistor power amplifiers. Micro-power to MOSFET-power, it's all here...

WHEN THE FIRST TRANSISTORS arrived in the early 1950s, they barely had enough power to operate as preamplifiers let alone drive a loudspeaker. But as things developed and power transistors began to appear en masse, the question was how to turn these things into audio power amplifiers.

Now you have to remember that previous to that, back in the days of valves, nine wireless sets out of ten simply used a single power 6V6GT valve driving the primary of an output transformer.

The reason was that because valves generally operated from a 250VDC supply, they could produce a large voltage swing — albeit at a fairly high impedance. Not the stuff of driving what was then typically a 3-ohm speaker.

The way around the problem was to use a transformer. This idea was developed during the early 1800s by Michael Faraday, one of Britain's greatest pioneers.

Two separate coils of wire, known as the 'primary' and 'secondary' windings, are wound around an iron core. If you feed an AC signal in the primary, you will see that same AC signal in the secondary even though there is no physical electrical connection.

The importance here is that depending on the number of turns and the impedance, you can make a high voltage, high impedance signal into a lower voltage, low-impedance signal suitable for driving a loudspeaker. While the 3- and 5-watt output transformers used in valve radios are no longer available from the local stores, you can buy miniature output transformers costing around $3 that are good for about 350mW.

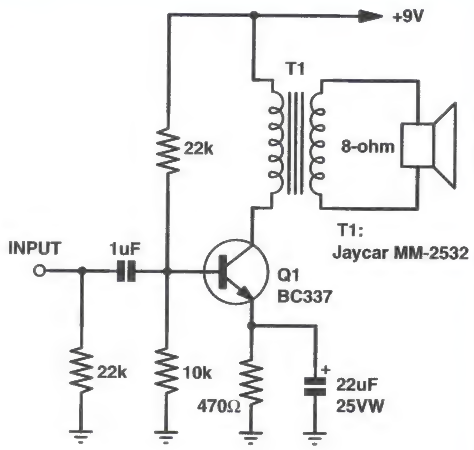
POWERAMP 1

Looking at the circuit in Fig.1, we've used one in this simple transistor power amp. This circuit relies on a BC337 transistor with the primary of the transformer connected as the collector load. In virtually all respects, this amp is the same as the single transistor preamp (Fig.1) from last month, however it suffers from a few major drawbacks.

First off, single-ended transformers such as this can suffer from what's known as 'core saturation'. Throw enough DC in the primary winding and the transformer core 'saturates', meaning that it becomes magnetized to the point where it no longer has the inductance to be able to hold our AC signal. The result is a very small and distorted signal at the output.

The other problem is that this circuit isn't even good for half of a watt. Even in valve days, single-ended amplifiers were rarely able to pump out much more than 10 watts, and that was with a transformer fifty times the size of this little fella.

Fig.1



This little circuit isn't terribly pretty, but you should be able to get something to squawk out of the speaker.

POWERAMP 2

For a really practical circuit, you can't go past this one in Fig.2. It uses four transistors, the last two in what is known as a 'complementary push-pull' configuration and has quite a few benefits over that in Fig.1.

First up, there's no costly output transformer. Next, you can easily set the overall gain by just a single resistor R1, and with the right transistors, you can also extend the output power to about five watts from a 19VDC supply rail.

If you look closely, you should be able to see that the part of the circuit built around transistors Q1 and Q2 is all but the same as that in Fig.3 from last month, except that Q2 is now the driving transistor for the two output devices, Q3 and Q4.

A couple of things about this circuit: Firstly, as shown, it's pretty easy to get going but make sure you include those one-ohm emitter resistors at the output — they're the output devices' insurance policy.

In many designs, these resistors are left out, leaving the circuit open to what's called 'thermal runaway'. Thermal runaway takes place like this: imagine those emitter resistors are not there, and the two emitters are connected together and to the output capacitor.

The diode and 100-ohm resistor connected between the two bases are designed to ensure that there is between 1.1 and 1.2V between them, to bias Q3 and Q4 on. Without that voltage, you'd end up with crossover distortion at the output, which sounds horrible at low levels.

Anyway, as current flows through the transistors, they heat up slightly and that heat causes the transistors to turn on slightly more - more voltage between base and emitter (Vbe). That creates a little more heat, which creates a little more Vbe voltage, which creates a little more current flow, which creates a little more heat and before you know it, you've got two smoking output transistors.

Those emitter resistors prevent this from happening.

As current flows through the transistors, they still heat up but that current now causes the emitter voltage to rise because of the one-ohm resistors. That in turn causes the Vbe voltage to drop and the transistors to turn further off, dropping the current. That drop in current then reduces the voltage across the resistors, which allows the transistors to turn on more, which produces more current, which causes the emitter voltage to rise and around we go again.

Hopefully, you can see that the output transistors will self-regulate (within reason) and remain quite stable and happy. Put too much voltage across that diode and 100-ohm resistor though, and the transistors will turn on hard and the emitter resistors won't stop them from eventually blowing up.

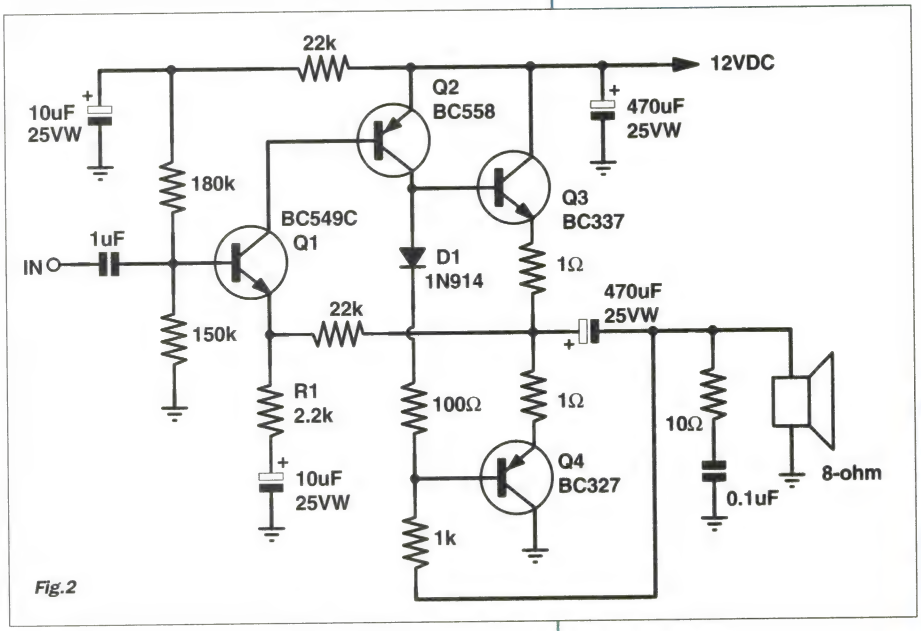


Fig.2

With a 12VDC supply, this circuit will pump out 1.5W into an 8-ohm load — more than enough even for a real budget bedroom amp.

The 22k resistor and 10uF capacitor in the supply rail help to ensure that the base voltage of Q1 is nice and smooth — any supply rail ripple here will get amplified right through to the speaker.

The 10-ohm resistor and 0.1uF capacitor at the output create what's called a Zobel network, and this reduces the high-frequency impedance of the speaker load. Speakers themselves are horrible nasty things to drive because they're not resistive – if they were like a straight ordinary resistor, they'd be as easy to drive as an automatic-transmission car.

But they're not – they have a significant reactive component, and one of the ways that shows up is the impedance increase with frequency. That impedance increase can make amplifiers unstable and prone to oscillate at high frequencies. The Zobel network makes sure that the load impedance never rises above 10 ohms.

Vbe MULTIPLIER

We can further improve the circuit in Fig.2 by adding in what's known as a 'Vbe multiplier' or 'amplified diode'. In Fig.2, the diode and 100-ohm resistor are very convenient and simple to install, but it's not what you'll find in high-fidelity discrete (meaning "still use transistors") amplifiers.

The reason is that the resistor and diode have a significant dynamic impedance, which means that the NPN output transistor (Q3) isn't seeing exactly the same signal amplitude as the PNP output device (Q4) — not what you really want in a complementary output stage.

The diode and resistor, which are in place to ensure that enough current flows through the transistors in their quiescent (no signal) state so there's no crossover distortion, also have another problem. They can't really track the thermal changes in the output devices caused by the current flowing through them.

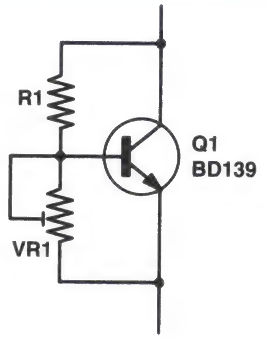
OK, before we go any further, let's look at how it works.

Fig.3 shows resistor R1 and trimpot VR1 are connected between transistor Q1's collector and emitter, with the junction heading off to the base.

We already know that Q1 needs 0.6V between its base and emitter before it turns on, so the ratio of R1 to VR1 allows us to set the voltage across Q1 to any desired level. Reduce VR1 and you increase the voltage drop across Q1, and vice versa.

As our circuit in Fig.2 uses just two output devices, we need something close to 1.2V to ensure minimum crossover distortion. This would mean that VR1 would be adjusted so that it basically equaled R1 in value, but you would need to check the current flow through the output devices (no more than 10mA) rather than just rely on a magical number.

Fig.3



Now, to ensure that Q1 thermally tracks the output devices, it's usually mounted on the same heatsink as the output devices so that it is subjected to the same temperature changes.

MOSFET POWER AMPLIFIER

For serious power amplifiers, no one really uses Bipolar Junction Transistors (BJTs) any more — they use MOSFETs instead.

MOSFET stands for Metal Oxide Silicon Field Effect Transistor and in many ways, they operate very similarly to a power output valve. Rather than a collector, base and emitter, MOSFETs have a drain, gate and a source.

MOSFETs have a turn-on voltage similar to a BJT's Vbe, called Vgs — that is, the voltage between the gate and the source. However MOSFETs are not as obliging as BJTs since the Vgs figure can float over a fairly wide range, from as little as 0.1V to as much as 2V. It depends on the device, but our Vbe multiplier from Fig.3 is perfect in this situation as well.

Fig.4

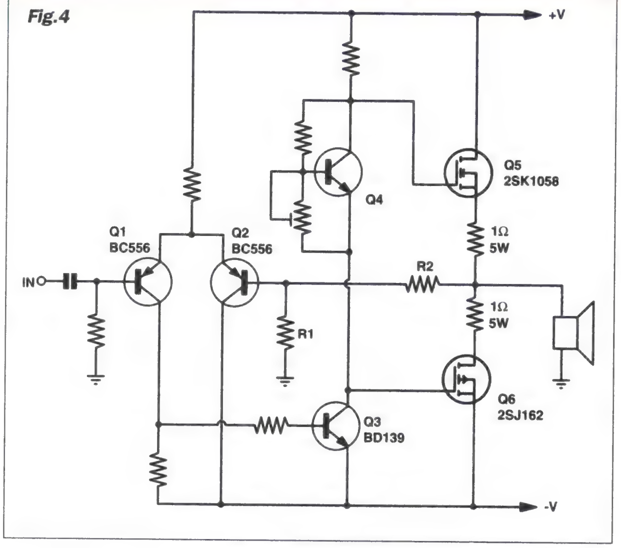


Fig.4 is a simplified version of a power MOSFET amplifier. It's basically only the 'shell' so you can see what's going on — don't build this circuit up unless you can figure out the missing parts.

Transistors Q1 and Q2 form what's called a 'differential pair'. The input signal feeds into the base of Q1 while a portion of the output signal drives the base of Q2. A differential pair works exactly the same way as the inverting and non-inverting inputs of an op-amp. In fact, you can consider Q1's base as the non-inverting input and Q2's as the inverting input.

The output of the differential pair drives driver transistor Q3, which in turn drives the Vbe multiplier Q4 and MOSFET output devices Q5 and Q6, both available from Jaycar Electronics. The ratio of resistors R1 and R2 set the overall gain of the amp, because they provide the negative feedback.**ea**

Further reading

For more reading on audio power amplifiers, I suggest you take a look at John Linsley Hood's '*The Art of Linear Electronics*' (Butterworth Heinemann), which has some good info on amplifier design as well as MOSFETs and how they're made.

TV sets – and other animals

Animals and 'beasts' feature largely in this month's column. The animals are small but real. The 'Beast' is much bigger and led our contributor on a merry dance before it was conquered.

OVER THE YEARS we have had numerous stories about the mayhem caused to electronic equipment by animals, both domestic and wild. Off hand, I can recall stories about cats and dogs, rabbits, mice, a duck, ants, spiders and possums. For the most part, those animals survived their encounter with matters electrical although often with fur or feathers missing. This month's lead story has not quite such a happy ending.

The tale (or could it be 'tail') comes from Nick Pye, of Mackay in Queensland. As you will see, a certain TV set came close to wiping out the entire local population of... But I should let Nick tell the story himself. He calls it "The Gecko CTV".

We are located in Mackay Queensland, close to the Whitsundays and our tropical climate and natural surroundings can provide some interesting repairs from time to time. On this occasion a Sony portable CTV (model KV1415) was brought into the service center with the complaint that it was dead. The CTV turned out to be not the only thing that was dead!

The job was allocated to Lisa, our female technician and she started to dismantle the set. Moments later several loud screams were heard from the TV workshop. I rushed out, and was told that the TV was now 'my job', and that "...there are dead things hanging out of the set". She walked off muttering something about not doing all that study to pull dead things out of TVs and I was left to evaluate the condition of the set (and my ears).

Lapsed lizards

The TV had three dead geckos fried on the circuit board. They were obviously 'Slow Blow' geckos because they had managed to burn a hole clear through the PCB before the mains fuse had blown! I estimated the large one at about five amps and the smaller ones at three amps each.

They were removed and attached to an electrotherapy device but they didn't respond. Perhaps the device had been dropped or the geckos had the wrong attitude. I don't know. Anyway, they were put to rest, with much pomp and ceremony, by throwing them in the bin and the repair commenced.

The damaged section was cut out with a grinder and the circuits reconnected with heavy wiring. The mains fuse was replaced and the set fired up and displayed a lovely picture .

I wrote up the job card and noticed that the set had been in about six months earlier. I opened up the previous job card and to my amazement, the last repair involved pulling no less than seven dead geckos from the same set! This CTV had now claimed 10 of the little creatures!

I swore (this is something only male technicians do) that if I let this set go back to the customer, I could be responsible for destroying the entire local gecko population! After much soul searching, I was persuaded to return the set when the customer offered me money.

The thing that surprised me was that they said they would try to prevent the geckos getting into the CTV again. But that ignores the fact that there are still more geckos living in the house with them. Perhaps they keep the cane toads out!

That's all from sunny Queensland, beautiful one day — devoid of geckos the next.

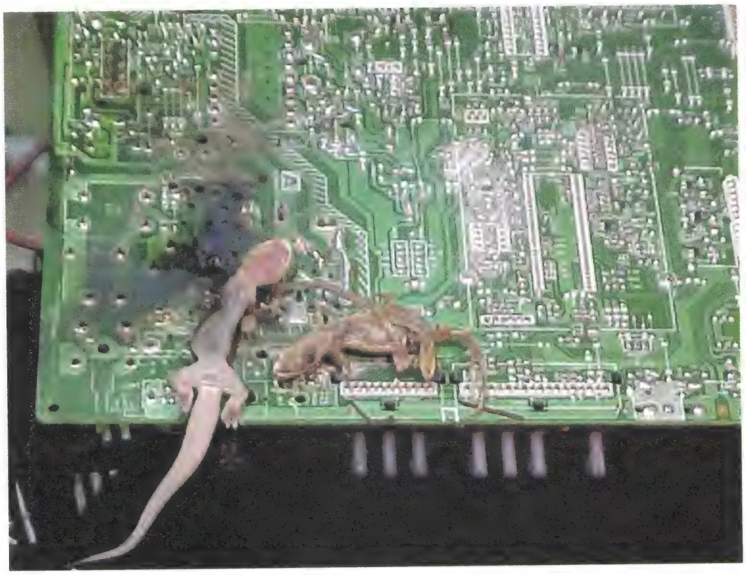
So there's another animal to add to the list of destructive critters we should be aware of. And my imagination can supply the sound effects as Lisa took the back off that TV.

I might have been inclined to discount Nick's story if he had not supplied photographic evidence of the 'slaughter'. Three at a time is considered good shooting, but I wish we had a photo of that earlier massacre. That would be something to see.

Thanks for that story Nick. And let's hear from you again if you ever come across a dead cane toad (or crocodile) in a TV!

Battle with the Beast

Now we come to a story about a beast of a different



The unfortunate *demise of a Sony CTV turned out to be caused by the unfortunate demise of several Gekos - and it wasn't the first time ...*

kind, and one we haven't seen often in these pages. It's a motor vehicle, a VW Kombi to be exact, and the story of it's demise and resurrection comes from Glenn Castle, of The Gap, in Queensland.

We have often commented on the complexity and exorbitant cost of auto electronics. Glenn's story shows that sometimes the cost can be minimised, if one is prepared to expend the time to properly investigate the fault. Here's what he has to say.

In late January 1990, a close friend of mine was to travel to Indonesia for an extended stay, to work in his field of botany at the Bogor University. At a farewell get-together, I mentioned to him that if his wife, who was remaining in Brisbane with their sons, needed any assistance with maintenance of their house or car she should not hesitate to give me a call.

On the following Friday afternoon, my wife rang me at work to say that Jill's VW campervan was stalling continually and could I look at it. The 'crampervan' (as I had always called it) had been abandoned less than a kilometre from home and wouldn't go for more than 50 metres or so before stopping.

After some anxious moments, I finally got the thing to my driveway where it died completely. A tremendous thunderstorm hit Brisbane that night so I could not investigate the ailing health of the VW until the next morning.

The automatic campervan, with full Trakka conversion, was a 1982 model with 87,000km on the clock and was in pristine condition. Although the engine would fire sometimes during cranking, it would no longer start no matter what I did.

One morning about a week before leaving for overseas, David was going to work when the vehicle decided to entertain other motorists unlucky enough to be in the vicinity by putting on an impressive display of pyrotechnics. One of the EFI (Electronic Fuel Injection) fuel hoses had burst and the engine bay caught fire. Although the fire was soon extinguished, the wiring loom was damaged and the engine bay had a charred look and smell to it. David replaced the offending fuel hose, spliced some new wires into the wiring loom and the VW revived, albeit temporarily. On reflection, I do not think he should have interfered with its cremation which I suspect had been ordained by nature. I felt that there may well have been a connection between the fire and the Kombi cadaver now stuck on my driveway.

I spent a large part of the weekend working on it and identified:

- *Two open-circuit spark plug leads (probably a by-product of the fire.*
- *Worn distributor points.*
- *A very leaky distributor capacitor*
- *A burnt vacuum advance hose and cold start valve hoses, and*
- *Some loose splices to the wiring loom.*

I replaced the faulty parts but still the engine wouldn't start. Further tests revealed no faults with the fuel pressure, ignition and valve timing or the engine compression. I'd had absolutely no experience with EFI systems but it was obvious that this was about to change, whether I wanted it or not.

Analogue computer

The campervan was fitted with a Bosch L-Jetronic EFI system whose control unit was an analogue computer. As I came to find out, the pulse train to the injectors is locked to half the frequency of the ignition pulses and the pulse width is a function of the air flow rate, the air and engine temperature, whether or not the throttle valve is fully opened, whether the engine is being cranked, and vehicle system voltage.

So I spent many a happy hour checking each one of these inputs into the computer. I did find that the engine temperature thermistor was well and truly outside specification. But bypassing it with a suitable resistor still wouldn't allow the engine to start.

After a week, I hadn't a clue what was wrong with the beast which was still choking up my driveway.

During the week I had phoned the VW technical people who had stressed how important the correct compression and engine temperature sensors were to the starting process.

They suggested checking the injector resistors, which should be 3Ω, but I had no luck here. They also said that the Bosch control unit was highly reliable and not likely to be the culprit.

During the second weekend, I removed an injector and placed it in a tin can while my wife tried to start the engine. A small amount of fuel did come out but the injector did not appear to be pulsing properly. At last I had some inkling that the problem was in the fuel injection system and, because of all the tests I had already carried out, it was most likely in the computer itself. Obviously, the worst scenario one could think of!

A quick check revealed a new computer was worth $1060, (for 'worth', read 'cost'. Ed.) *but one needed to be 100% sure before spending that sort of money.*

A work friend of mine had a much older manual VW Kombi ute which had an earlier version of the L-Jetronic EFI system. Although the manual and automatic vehicles are fitted with different variants, I thought it was worth swapping control units.

With trepidation, I approached my work mate with this idea and surprisingly he agreed to it. Obviously, there was some risk. If the control unit in the campervan was in fact faulty, it could have failed due to a spike or incorrect voltage on one of its inputs. Therefore a foreign control unit could be damaged during substitution.

We tried the campervan's control unit in my friend's Kombi and the engine fired occasionally but just wouldn't 'catch' — a very familiar story. Then I took my generous friend's control unit back to the beast on my driveway.

With considerable nervousness, I cranked the engine and, after being in a dormant state for over two weeks, it roared into life and idled flawlessly. What a break-through! At last I was able to tell Jill the good news, that I knew precisely what was wrong with her VW. But alas she did not share my excitement — she realised the full ramifications!

Repair job

Early the following week I found that no company in Brisbane at that time repaired the Bosch control *units. And as expected, I was not able to obtain a copy of the circuit from either Bosch or VW. There didn't seem a lot to be lost by having a go at fixing the control unit myself. I could hardly make the situation worse.*

To test the computer, all I had to do was to remove the wiring loom from the vehicle and to simulate each of the required inputs. This was relatively easy except for the train of ignition pulses.

The VW has an idle speed of 780 RPM which equates to 13Hz. So I made up an astable multivibrator using a 555 IC to oscillate at twice this frequency to simulate the distributor pulses of a 4-cylinder engine. I connected the output to a relay which in turn drove a 12V ignition coil. At the time I was trying to simulate the ignition points' spikes which I recalled were of the order of 75V. This voltage was due to the back EMF in the primary winding of the coil but subsequent tests revealed it was possible to drive the Bosch control unit directly from the output of the 555.

It was obvious I was going to need an oscilloscope so, on the third Saturday of this saga, I bundled up the control unit, wiring loom and simulator and went over to a friend who had an excellent CRO. We soon discovered that the ignition pulses went into a Siemens chip in a TO5 package. This IC shaped the incoming pulses and also carried out a divide by two function.

The resultant pulse train then went to an LM2901 quad voltage comparator which is similar to an LM339 but has tighter specifications, particularly with respect to temperature (-20°C to +85°C).

Basically, the pulse train could be traced through the first and second comparators and, although it arrived intact at the third stage, only random intermittent pulses came out of pin 1. I couldn't buy a replacement chip until Monday so I traced out the circuitry around the LM2901 to see if some other component was affecting the IC.

No other faults could be found in this part of the unit but in a different part of the board I found a diode where the glass encapsulation was cracked through and the diode measured open-circuit. From the partially intact markings, it was possible to tell that it was a Zener diode but it was impossible to determine the value. Just another problem!

At last the replacement LM2901 was soldered in and some checks were carried out to determine that the injector outputs were pulsing. The wiring loom was re-installed in the vehicle and the control unit was connected up temporarily. On hitting the ignition switch, the engine roared into life. Success at last!

Now for the problem of the Zener! On tracing out the circuit around it, I found that the Zener was in series with a 680 ohm resistor to an 8V supply. I tried five different Zeners in the range of 3.3V to 6.8V and measured the idle speed and time the engine took to stall when the auxiliary air hose was removed.

To be honest, there was little difference between them but the 4.7V Zener appeared to be best but only by the thinnest whisker. I guess I expected the Zener to be in the range 4V to 5V where the temperature coefficient is close to zero.

Scorched sensor

But installing a 4.7V Zener wasn't quite the end of the story. When I went to test drive the VW, I found the oil pressure light wouldn't extinguish. The oil pressure sensor was a charred mess.

It was too risky to drive the animal with a faulty sensor that could spring a leak at any instant so my frustration level did not subside. On the next day, a three station train excursion and a long walk got me once again to the VW spare parts distributor where I purchased a sensor.

That night when the oil pressure light still refused to turn-off after the new sensor was installed, I was sorry that that dog of a 'crampervan' hadn't burnt to the ground a month earlier.

Next day I returned to the VW spare-parts man. This time I was armed with a cotton-bud and multimeter and tested the replacement sensor on the spot by gently depressing the diaphragm with the cotton-bud to check that the contacts opened.

The spare-parts man didn't say a word but I am sure from the expression on his face that I was the weirdest, most eccentric customer he had ever had the misfortune to come across.

Unfortunately, I was back to see him the next day. Further testing revealed that the gearbox console start inhibitor switch was faulty, the distributor vacuum advance unit was inoperable having been destroyed in the fire and the horn/reversing light fuse was open circuit.

Finally, the campervan passed all tests and three weeks to the day I delivered it back to Jill. It was their sole vehicle and her thrill of getting it back paled into insignificance compared with the pleasure I was experiencing in getting that thing off my driveway.

Nevertheless my friends were a bit overwhelmed by the bill for parts which had progressively added up to $250. On his return from Indonesia, David, with Jill and their boys took the five of us out to a restaurant to show their appreciation.

In hindsight, I think I got more satisfaction out of fixing that thing than from any other repair I have ever carried out. I believe the satisfaction you get out of anything is the product of the level of effort expended and the level of frustration experienced.

By the way. David and Jill still have the van, still with the original control unit, ten years later!

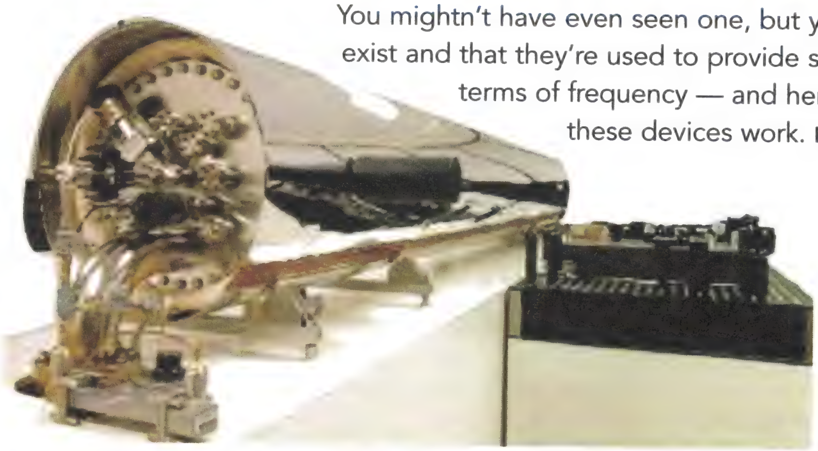
Well! Glenn doesn't leave me much to say about that story, does he?

We have had a few stories about auto electronics in recent years, but few had the happy ending that this one does. Glenn may have been badly frustrated during the period of that story, but he has gained a lot of experience which he has been able to pass on to readers. I know that I've learned a lot about EFI and car computers from the story.

Thanks for telling us about your experiences, Glenn. And by the way. I've got another story of yours waiting to be edited. It's something for readers to look forward to. And that's all for this month. There are some good yarns in the pipeline for next month, but there is still plenty of room for more. I look forward to hearing from you. **ea**

Atomic Clocks

You mightn't have even seen one, but you're probably aware that atomic clocks exist and that they're used to provide signals that are extremely accurate in terms of frequency — and hence time. Here's a quick look at the way these devices work. **By Jim Rowe**



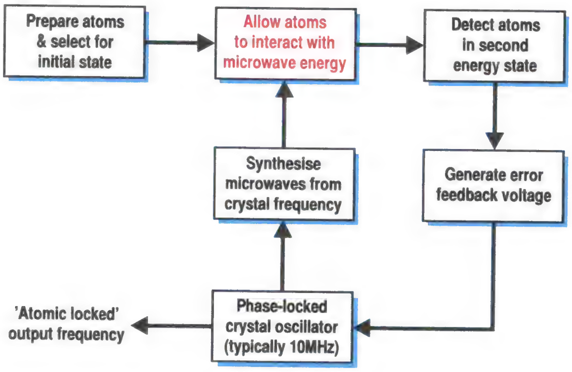
***This cylinder** houses one of the most accurate clocks in the world. NIST-7, the seventh generation atomic clock at the National Institute of Standards and Technology, will gain or lose about one second in six million years.*

THEY'RE CERTAINLY NOT the kind of thing you find in every home, or even in many labs. But you *will* find them in standards labs, and anywhere that a source of really accurate timing signals is essential. For example all of the satellites orbiting the Earth in the Global Positioning System (GPS) have atomic clocks aboard, and they're being increasingly used in many of the latest high speed data communications networks, to ensure system synchronisation.

So what *is* an atomic clock? Well for a start, they have nothing to do with uranium, plutonium or other worrying radioactive materials. Nor do they involve generating energy from nuclear fission or fusion — so there's no risk of explosions or nasty radiation.

Traditional mechanical clocks and watches used a mechanical governor system (the pendulum and escapement) to regulate the speed at which the various spindles could turn — so that their movement became a reliable indicator of the passage of time. Essentially that's what atomic clocks do too, except that they make use of a different type of governor system. One that's much smaller, but inherently a lot more accurate.

***Fig.1:** The basic configuration of most atomic clocks. A specific atomic energy level transition is used to lock a crystal oscillator to precise frequency.*


Prepare atoms & select for initial state
Allow atoms to interact with microwave energy
Detect atoms in second energy state
Synthesise microwaves from crystal frequency
Generate error feedback voltage
'Atomic locked' output frequency
Phase-locked crystal oscillator (typically 10MHz)

To understand how this works, you're perhaps aware that atoms of virtually all elements can have different energy levels, or 'excitement modes'. At a temperature of absolute zero (-273°C) they are in the lowest energy level or 'ground state', but whenever they absorb energy their nuclei and orbiting electrons adopt more 'excited' states — in terms of magnetic spin, orbital level/momentum and so on. You'll perhaps also recall that because there's only a finite number of these excited states, with specific energy level differences between them, the atoms can only absorb energy in finite sized lumps or 'quanta'.

Now as it happens, atoms of certain elements can exist only in a relatively small number of these excited states, with energy level differences which can therefore be very accurately identified. So if under the right conditions they can be prompted to flip between two of these levels, the transition will involve absorbing a quantum of energy which can be very accurately measured.

It's this ability of the atoms to absorb an accurately defined quantum of energy which allows them to be used as a 'governor' for a clock.

But how does their ability to absorb accurately defined *energy* quanta translate into regulating *time*? Ah, that's because when the energy comes from electromagnetic radiation, it's already in the form of quanta — called *photons*, of course. And the amount of energy in a radiation photon is directly related to its *frequency*, according to this well-known relationship:

$$E = h \times f$$

where E is the energy, f is the frequency and h is Planck's constant (6.62517×10^{-34} joule-seconds), a universal constant.

So what this means is that atoms of these elements can be made to behave as a very stable and 'high-Q' absorber of radiation at one specific frequency — where the photons have exactly the right energy to flip the atoms between their well-defined energy levels. In effect, the atoms form a kind of pre-tuned circuit, which resonates and absorbs energy only at a very accurately known frequency. This allows us to use them to lock an electronic oscillator precisely to that frequency, and hence form the basis of a frequency and time reference.

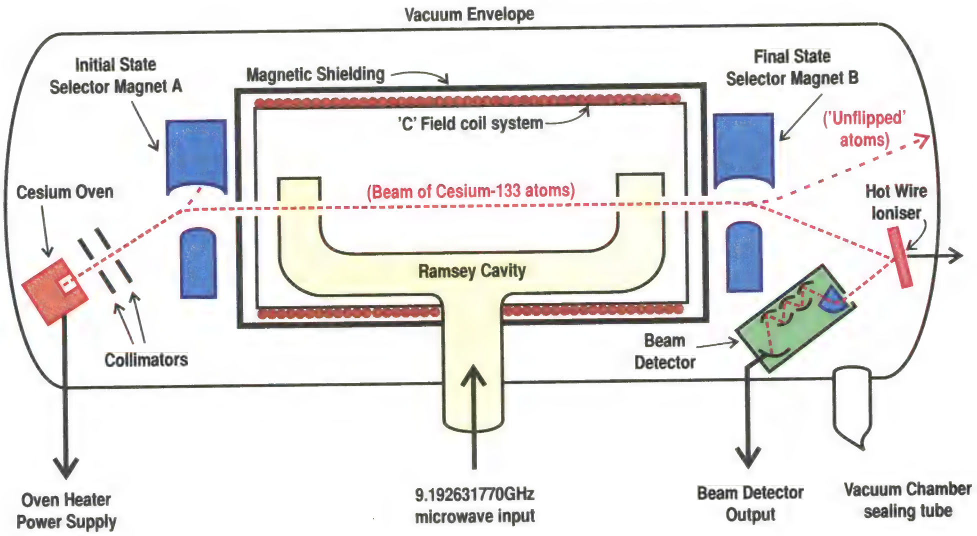


Fig.2: *What's inside a typical cesium-beam tube, which forms the 'heart' of a cesium-beam atomic clock.*

Atomic time

By the way, it's because this kind of atomic energy transition *can* be defined so accurately in terms of its radiation absorption frequency that an atomic transition has actually been used to define time measurement itself, ever since the 1960s. Here's the definition of the second:

The second is the duration of 9,192,631,770 periods of the radiation corresponding to the transition between the two hyperfine levels of the fundamental state of the atom of Cesium-133.

This definition of time is known as **atomic time**, and is the foundation of the UTC (Universal Time Coordinated) system used throughout the world.

Incidentally Cesium-133 was chosen as the element/isotope used to define the second precisely because it has two very well defined ('hyperfine') energy levels in the ground state and is also easily vapourised.

The basic idea

Fig.1 shows the basic idea of most atomic clocks, and illustrates how the atomic transitions are used to regulate the frequency of an oscillator. As you can see it's essentially a phase-locked loop system.

The energy quanta for the transitions concerned generally correspond to frequencies in the microwave region, but because it's not easy to generate stable oscillations at such frequencies directly, the clock's main oscillator usually employs a quartz crystal running typically at 10MHz. A frequency synthesiser is then used to effectively multiply this frequency up into the microwave region, to produce photons at the correct nominal frequency for the atomic 'resonance' effect.

The microwave energy is then applied to the atoms of the material concerned, which have been carefully selected beforehand to be 'resting' in the lower of their two well-defined energy levels. Then *after* the microwave irradiation, a detector system is used to monitor how many of the atoms have been 'flipped' over into the *other* energy level.

Needless to say there will be a peak in the number of atoms exiting with the second energy level, when the microwave energy used to irradiate them has been adjusted to have exactly the right frequency for their built-in 'resonance'. If the frequency is too high or too low, the number of 'flipped' atoms will drop away...

So by using the output of the detector to produce an error-correction feedback voltage, and using this to fine-tune the crystal oscillator, its frequency can be pulled into exact 'lock' with a submultiple of the microwave resonance frequency of the atoms.

This is *NIST's newest primary frequency standard, NIST-F1. It's a cesium-fountain frequency standard that has a frequency uncertainty less than 3 parts in 1015. The laser systems used for atom cooling and manipulation are on the optical table and intermediate level platform.*

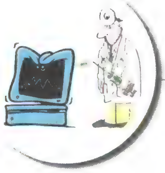
The cesium-beam clock

Perhaps the most common type of atomic clock is the cesium-beam type, so let's use this as a specific example to make things clearer.

As you'd expect, the atoms used in the cesium-beam clock are those of cesium-133, the very same isotope used in the definition of atomic time. And because the same two hyperfine energy levels of the cesium-133 atom specified in the definition are used, the microwave frequency used is not surprisingly again 9,192,631,770Hz — or 9.19263GHz, if you prefer. The 9.19263GHz radiation interacts with the cesium-133 atoms inside the *cesium-beam tube*, which forms the heart of this type of clock. The basic configuration of a typical cesium-beam tube is shown in Fig.2.

Inside the tube, a small block of cesium-133 is heated inside a tiny oven, so that it is very slowly vapourised. The liberated cesium atoms are then passed through holes in collimator plates, from which they emerge as a relatively narrow beam. This is then passed through a gap in a selector magnet system, which separates them into two sub-beams according to their energy level. The atoms in the unwanted state are discarded, while those in the wanted 'input' state are deflected so they pass through the tube's central vacuum chamber.

(Continued on page 97)



BY JEAN BAPTISTE CATTLEY

More Trojans, Auto FTP and **mini movies**

Viruses In a scrap

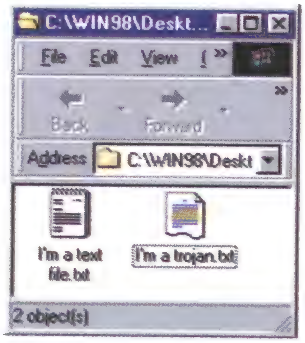
In my previous article on trojans and malicious files, I neglected to mention one of the sneakiest file types out there: .shs files, or Shell Scrap Objects. Scrap Objects were intended as a halfway point between the clipboard and full-fledged documents. If you drag text out of compatible applications, such as Microsoft Office or Wordpad, and drop it on your desktop, a 'Document Scrap' icon will appear. Drag this icon into another document, and the text will be pasted in, with all the formatting intact.

That's faster than saving it out as a file and attempting to insert it, and more versatile than relying on the clipboard — you can have as many items as you like stacked up, and you don't lose it all between reboots. Handy or what?

Trouble is, you can also include nasty little VBScript trojans (such as the dreaded life-stages trojan) in the selection as well, and send it to people. Since you all took my advice last month and view extensions in Explorer, you're all completely safe from this form of attack. At least, that's the theory. What nobody tells you is that Microsoft in their infinite wisdom (for whatever insane reason) decided to automatically hide the extensions for these files in explorer, regardless of whether you show extensions for other files. This means that a file named Trustme.txt.shs will always show up in Explorer as Trustme.txt, no matter what you do.

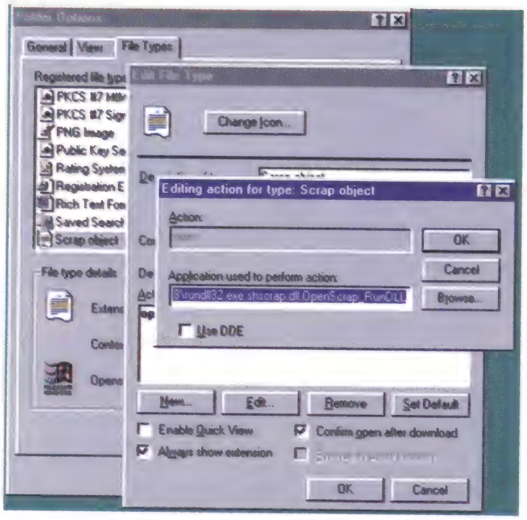
Now, everyone knows that a .txt file can't possibly cause any damage... Opening this file will of course open up its parent application, such as Word, and run any nasty VB macros inside.

To make matters worse, the icon for Scrap objects looks remarkably similar to the default text file icon, and it's remarkably easy to be fooled, especially if you use small icons. Luckily, it's easy enough to avoid getting burned: First, never download or accept files with a .shs extension. Thankfully, most browsers and mail clients show full extensions, so you don't have to worry.



While you might use the odd Scrap File now and then, you'd be best of taking it out the back and setting light to it. It's for the best. Really.

The second thing to do is to change the icon, so you don't fall for it. Open up Explorer and go to View | Folder Options -> File types, select Scrap Object, and click Edit, then Change Icon. Enter the path to a file with some icons in it, such as c:\windows\system\shell32.dll, and pick one that you'll never mistake for a harmless document. Now these files will stick out like a sore thumb, and you'll know to keep clear.



Editing action for type: Scrap object

Application used to perform action: 8\rundll32.exe shscrap.dll,OpenScrap_RunDLL

☐ Use DDE

☐ Enable Quick View

☑ Confirm open after download

☑ Always show extension

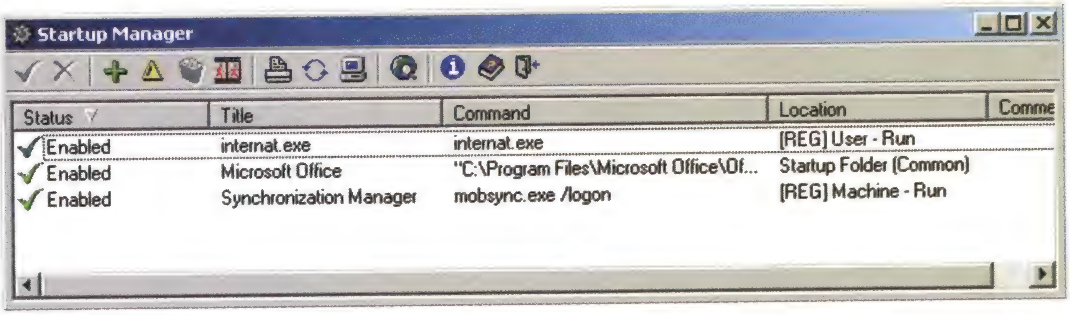
Of course, if you don't see yourself using scrap objects in the future, then another step you can take is to prevent the nasty little things from ever getting run at all. While you're editing the file type, select the 'Open' action from the list, and Click Edit. Change the 'Application used to perform action' to 'notepad.exe', and click OK. Now double-clicking .shs files will simply open them in Notepad, bypassing any embedded macros entirely. Of course, there'll be an awful lot of gibberish mixed in with the text, but it's highly unlikely that you'd want to read anything inside the file anyway. While you're at it, you might want to do this for .vbs files as well, as these are another favourite file type used by trojan writers.

Tour de Farce

When I boot up Windows 98 on my computer it always wants to take me on a "Tour of Windows 98". There seems to be no option to "Do not show me this again" and it is not on the Startup menu. How can I get rid of this annoying program?

(John Hassel, by email)

There are three programs that could conceivably be doing this: Tour98.exe, Welcome.exe or Discover.exe, though I'm not exactly sure why they're getting run at startup.



Status	Title	Command	Location	Comme
✓ Enabled	internat.exe	internat.exe	[REG] User - Run	
✓ Enabled	Microsoft Office	"C:\Program Files\Microsoft Office\Of...	Startup Folder (Common)	
✓ Enabled	Synchronization Manager	mobsync.exe /logon	[REG] Machine - Run	

If you want *to manage your startup, try, er, Startup Manager. It's a lot easier then digging around in the registery, that's for sure...*

Nonetheless, it's easy enough to stop it from happening, just open up Regedit and look inside the following keys:
HKEY_CURRENT_USER\SOFTWARE\Microsoft\Windows\CurrentVersion\Run
HKEY_CURRENT_USER\SOFTWARE\Microsoft\Windows\CurrentVersion\RunOnce
HKEY_LOCAL_MACHINE\SOFTWARE\Microsoft\Windows\CurrentVersion\Run
HKEY_LOCAL_MACHINE\SOFTWARE\Microsoft\Windows\CurrentVersion\RunOnce
HKEY_LOCAL_MACHINE\SOFTWARE\Microsoft\Windows\CurrentVersion\RunServices
HKEY_LOCAL_MACHINE\SOFTWARE\Microsoft\Windows\CurrentVersion\RunServicesOnce

If you find the programs listed under any of these keys, just delete that entry, and you should be right. Also look in C:\Windows\win.ini for any load= or run= lines containing the filename, and delete them as well. Of course, if you want to save yourself all this bother, simply head off to **www.delphifreestuff.com** and grab a copy of Startup Manager, a free utility that allows you to easily manage all your startup programs quickly and easily.

Squeeze frame

The biggest thing to happen to digital media in recent years would have to be MP3, making it possible for everyone to encode, store and exchange high-quality audio files.

Well, hold onto your hats, people, because the same thing is about to happen for video. There's a new video format out there called DivX (not to be confused with DIVX, a failed DVD pay-per-view system) that's downright scary. Based on the MPEG-4 compression format, DivX boasts amazing compression (around 15% of the size of DVD), with playback quality that leaves standard .mpg files out in the cold.

I have here a 71-second, 512 x 272 pixel DivX video (with 64kb/s sound included) that only takes up 8.26MB, with virtually no compression artifacts to be seen. Absolutely brilliant stuff, and with such a small file size, video clips for download are now a viable proposition. You can pack 80-90 minutes of 640 x 480 video onto a CD, obviously not with the perfect clarity of DVD, but far, far more watchable than anything else around (like those horrible VCD discs). This is the one to watch, people.

Download the codec for Media Player at **www.divx-digest.com/software/divxcodec.html**, then try out some of the movies at **www.divx-digest.com/movies/index.html** — and keep an eye out for DivX movies as they sweep the world — which I'm betting they will!

Also, there are encoders around that will allow you to convert from other formats into MP4/DivX - check the site's Software page for details.

Partition problem

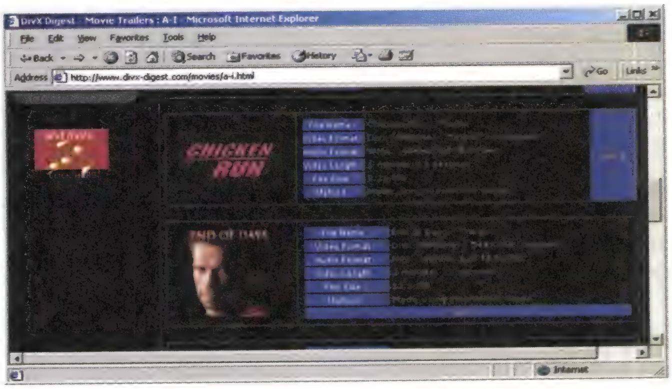
I am looking for a partitioning program which will keep the current information on my drive. I am planning to install Linux on my computer. I currently have a 10GB hard drive with Windows 98 on it.

Do you know of a good partitioning software that will let me do this without destroying my other partition?

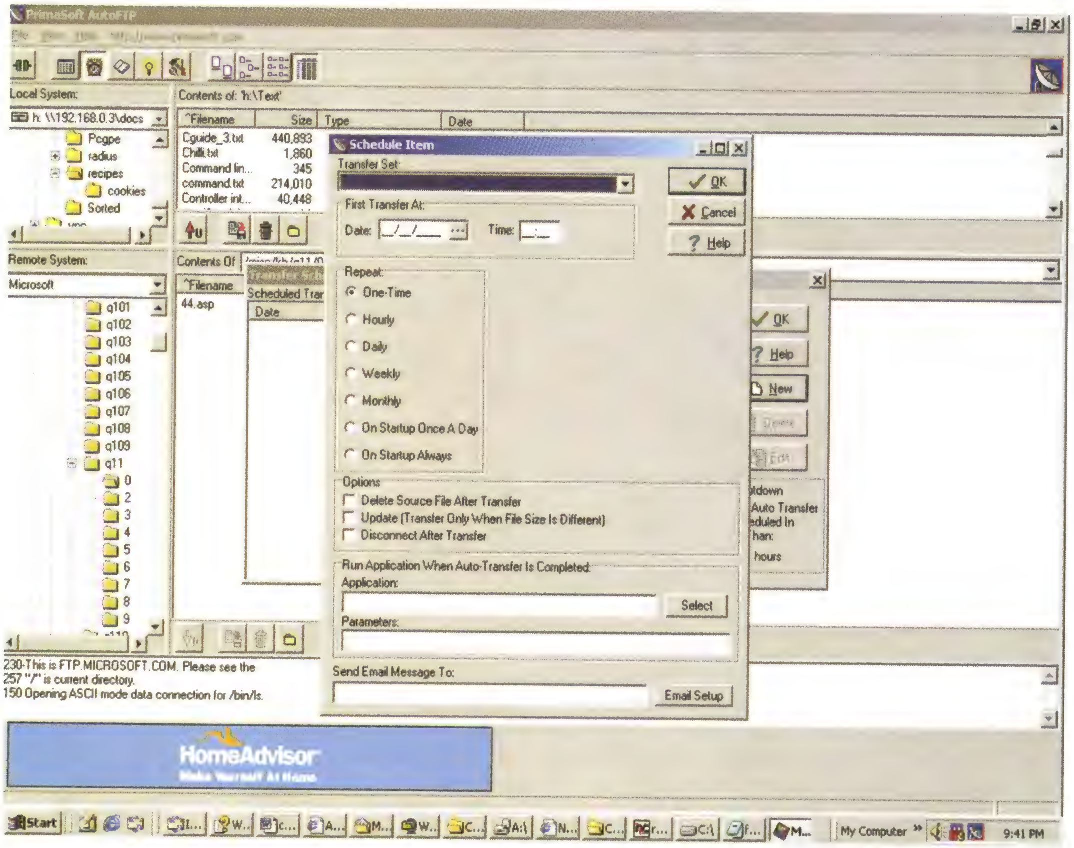
(Marvin, by email)

Surely. Perhaps the easiest solution is Partition Magic, from **www.partitionmagic.com**. At $69.95 US, it's not exactly cheap, but it does everything, and it's incredibly easy to use. However, if you're only going to use it once, I'd recommend a freeware utility such as fips, available from **www.igd.fhg.de/~aschaefe/fips/fips.html**.

Fips is a little scary, but then, so is linux. There's really no substitute for backing up your irreplaceable data on another drive before you start messing with partitions, no matter how good the partition manager you use — murphy's law always holds true where computers are involved. Before you run fips, you must defrag-


DivX Digest - Movie Trailers : A-I - Microsoft Internet Explorer
File Edit View Favorites Tools Help
Back Search Favorites History
Address http://www.divx-digest.com/movies/a-i.html
Go Links
CHICKEN RUN
END OF DAYS
Internet

DivX *gives everybody the chance to release good quality video on the net. Everybody with a PC, that is, and some acting and directing skills would come in handy too, I suppose...*



```
230-This is FTP.MICROSOFT.COM. Please see the
257 "/" is current directory.
150 Opening ASCII mode data connection for /bin/ls.
```

***Here's AutoFTP**, an all singing, all dancing FTP client that does just about everything you want. Mind you, that little script looks so much simpler...*

ment your drive, to push all your data up to the top. Then run fips (from DOS mode — it won't run in a multitasking environment, and you really, *really* wouldn't want it to anyway...) and select the start and end cylinders you want for the next partition. When you install linux, simply delete the new partition that fips creates, and create a new ext2 partition in the free space. Simple, really, but try to do it in a distraction-free environment — mistakes could be extremely painful indeed.

Write on schedule

I've read every installment of Computer Clinic, and I think it's great! I run a small import company, and I would like to put certain information on my website on a regular basis (say, once a day). The data is stored and calculated in a database, and I have managed to get the application to generate a report in HTML. What I am looking for is a small, simple, no-frills way to upload this page every day, preferably as part of a batch file that can be run at startup.

Would Win95's FTP command be able to run with the parameters of user name and password to log on to my ISP and automatically upload the file? Should I use a script of some kind? Or is there some other software I can use? I've managed to get this far, but it would be really helpful if I could get everything to happen automatically, instead of my firing up CuteFTP every morning, logging on, and dragging the file across to the site. I hope you can help.

(George (no jokes, please) Lucas, by email)

They've thought of this one, and it's easy. Just use ftp.exe with the -s:filename parameter. The way it works is ridiculously simple: create a text file with the list of FTP commands to perform, and run ftp.exe -s:textfile. See box for an example of a command file. If you want a flashier way of doing it, grab yourself a copy of AutoFTP Pro from **www.primasoft.com**. It's free, albeit with bannerware sponsorship, and it does pretty much anything you could possibly want. Scheduled upload, invisible mode, auto-dial, auto-disconnect, auto-retry... the works. Personally, I'd go with the minimalist approach if at all possible, but hey, whatever works for you. **ea**

FTP commands

ftpcommands.txt

```
open ftp.myftpserver.com
myusername
mypassword
cd /pub/myuploaddirectory
binary
put myhtmlfile.html
put mypicture.jpg
quit
```

Then run the following:

```
C:\> ftp -s:ftpcommands.txt
```

BINARY-CODED **ROTARY SWITCH**

How do you select ten options with a tiny rotary switch that only has five pins? With a DIL-format binary-coded rotary switch, of course -- the 'user friendly' alternative to a conventional DIL switch bank.

Functionally equivalent to a common 4-way DIL switch with one side tied together, the binary-coded rotary switch does a very neat job of selecting between a number of discrete binary options. Rather having to select the correct binary weighting from four separate switches on a DIL switch-bank, the binary-coded rotary version allows you just dial up the setting directly. Neat!

The binary-coded example shown here came from Altronics, and is priced at $6.26 (Cat # S3001). **ea**

FEATURES

- Very compact
- Easy to use
- Low contact resistance
- DIL pinout

SPECIFICATIONS

Operating temp:	-10° to +60°
Contact resistance:	10mΩ
Switch rating:	5VDC 100mA
Insulation:	100MΩ @250VAC

VINTAGE RADIO

BY ROGER JOHNSON

Oddball Pre-octal Four Valvers

There were so many four-valve receivers produced in the pre-octal era that it's hard to generalise or even give a broad idea of their enormous range and variety. So instead, I've decided to look at four examples of really unorthodox designs — because these will at least illustrate the boundaries.

BEFORE WE START looking at these more unusual circuits, though, a few words about a fairly typical set of this era will hopefully set the scene.

In the April 1940 issue of *Radio and Hobbies*, the late John Moyle describes the 'Little General' receiver, in which he claims that this was 'the first radio of its type ever described...'

This is a somewhat erroneous claim. Small radios were certainly available commercially, and in any case the November 1, 1935 issue of *Wireless Weekly* carried the '4/35' superhet design — with a circuit almost identical to the Little General. It is built on a larger chassis (12" x 7"), uses valve types 6A7, 6B7S, 42 and 80, with no AGC, and the output is driven directly from the detector load. The only real difference is the volume control, which shunts the antenna to earth as well as increasing the 6B7S cathode voltage. A voltage divider is used for the various voltages instead of fixed resistors, and the text points out that the performance of such a set will depend upon the quality of the coil kit. In the next issue, a reflex version appears.

The Healing model 34

One of the earliest 3/4 valve 'straight' superhets in this country would have to be the Healing model 34 of 1934. This circuit is shown in Fig.1. As you can see it uses a 2A7 converter in which the volume control is a 5k pot in the cathode circuit. So where are the unorthodoxies?

Firstly, note the antenna connection via a tap down the coil. This was more typical in 1924 than in 1934, and is certainly an anachronism. The problem with this type of circuit is that the antenna length capacitively loads the coil, and affects the tuning. The antenna trimmer would have to be peaked for a given antenna length.

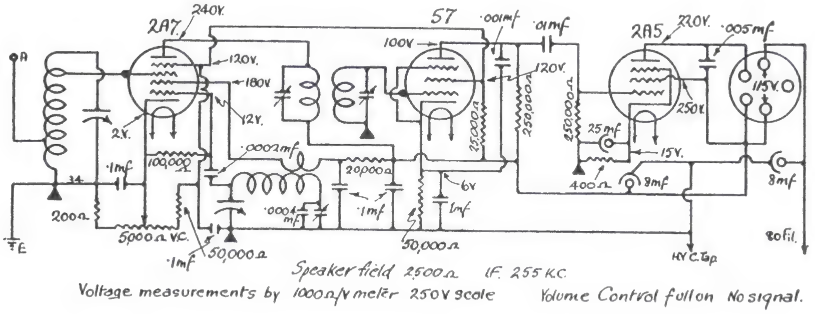


Fig.1: The Healing model 34, a superhet with no IF amplifier. The 57 valve is used as an anode-bend detector...

Secondly, the control grid of the 2A7 is also connected to a tapping down the coil. Tappings in this manner were generally to overcome loading effects. One would have thought that the loading effect of the converter would be minimal, to say the least!

The oscillator is conventional, as is the first IF transformer. The next tube, a type 57, is an audio amplifier, not an IF amplifier. The secondary of the IFT goes from grid to earth, and in the cathode of the 57 is a 50k resistor. This valve is operating as an anode bend detector and voltage amplifier.

No other circuits if this type have been seen by the author. If anyone knows of any similar circuits, perhaps they'd ley me know via EA.

The Healing 44B

This Healing, again from 1934, is a four-valve battery superhet. The circuit shown in Fig.2 has been redrawn from a poor copy of a very badly drawn original, for clarity.

Generally speaking, when using the older series valves type 30, 32 and 34, using only four valves was considered insufficient for a reliable battery superhet for anything else than a city location. The vast majority of battery superhets had at least an RF stage, and many went on to have push-pull class-B output using either a pair of type 30s, or the new type 19. To ensure reliable oscillator performance, many designers chose a type 30 or similar valve for a separate oscillator. So the minimum tended to be six valves, with many brands having seven or eight.

However, two valves changed all that: the 1A6 converter, and the type 33 output pentode. The 'Pentagrid 4' described in *Wireless Weekly* for May 1934 used those two valves, and could indeed claim to be 'a first of its type'.

So, why the four valve configuration in the Healing 44B? In fairness, if the radio was released in 1934, it was probably designed in 1933, and so hadn't kept up with the rapid pace of change.

This is indeed a four-valve battery superhet, but uses the old type 32 as an autodyne converter. Notice that the oscillator 'coupler' winding is in the filament; in fact there are two coupling windings, one on each side. They are (or should be) bifilar wound, and were done this way to ensure that each of the filament wires were at the same RF potential. This enhanced oscillator stability, but

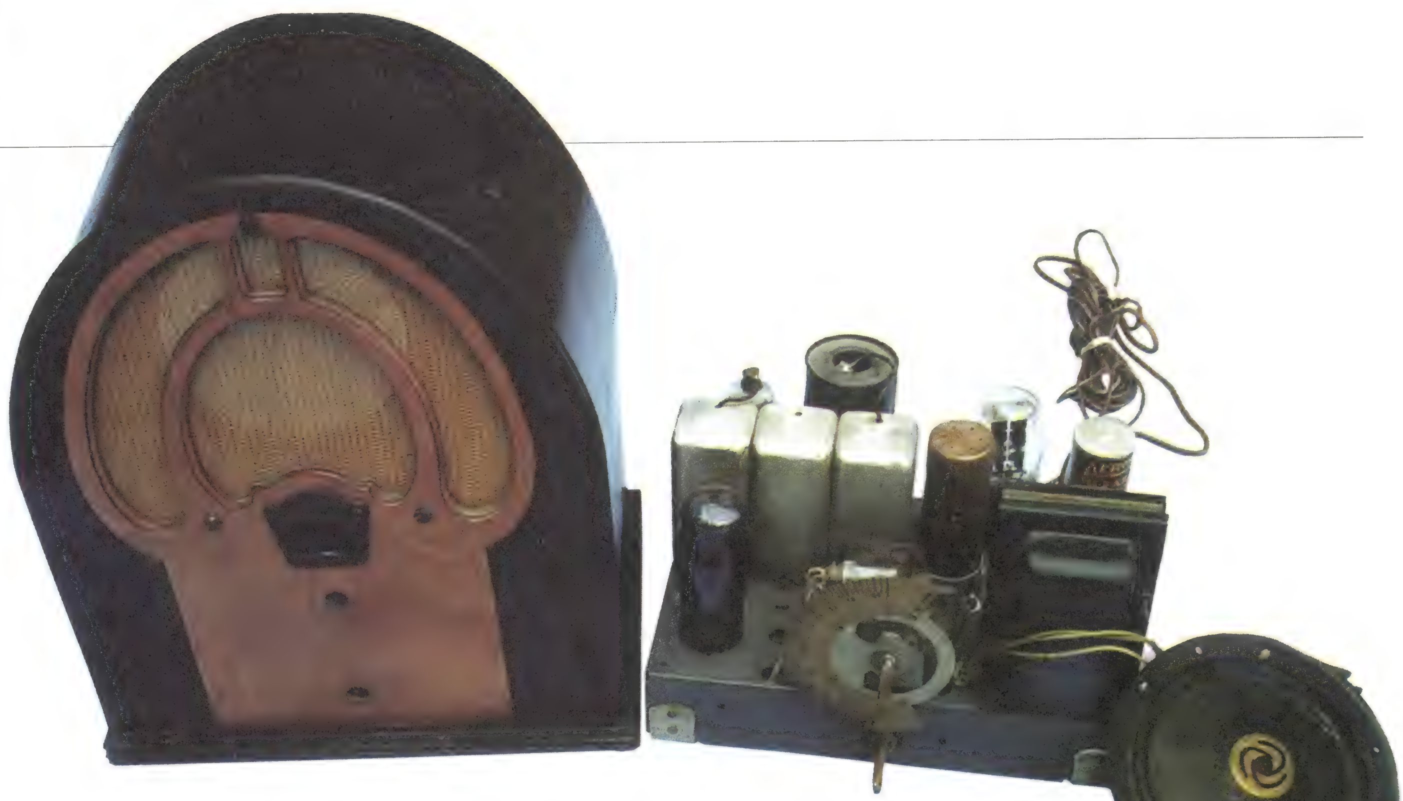


Fig.3: *The cabinet and chassis of a Philco model 80, a mains powered set with a circuit very similar to that of the Healing 44B. This particular set was purchased from the US via the Internet.*

there were circuits by other manufacturers in which only one leg of the filament was connected to the coupler.

The exciter, or 'tickler' portion of the coil is continuous with the tuning section and is fed from the anode via a 100pF trimmer. As a consequence, the primary of the first IFT is un-tuned. If it were shunted with the usual compression trimmer, the RF voltages would be shunted to earth via the bypass capacitors and/or the battery, and consequently it would not oscillate.

Indeed, the author spent many, many an hour puzzling over a similar oscillator circuit in a badly cannibalised Healing model 73B, in which an IFT had been scrounged from another Healing chassis and had two compression trimmers. It steadfastly refused to oscillate, despite completely re-winding the oscillator coil. When the trimmer was disconnected, *voila*!

The volume is controlled by varying the grid bias on the variable-mu type 34 IF amplifier. An RF choke is between the volume control and the bias battery to prevent stray IF being coupled back through the batteries to HT and causing instability. However why the 0.1uF bypass capacitor is earthed via the antenna coil primary is a mystery.

Next comes another unusual feature for an Australian radio: a regenerative IF amplifier/detector stage. The plate of the type 32 leaky grid detector is connected via a five-plate trimmer to a small tickler winding on the second IFT, as you can see.

Anyone who has tinkered with one- and two-valve regenerative detectors will know the importance of regeneration to receiver performance. Unfortunately, it is a characteristic of regenerative detectors that the amount of regeneration must be altered with each setting of the tuning capacitor. However in a superheterodyne, the intermediate frequency is fixed, so that the setting of the regeneration would be adjusted once during alignment procedure and then left alone. Such a control would inevitably be a chassis control, and not a panel control. Such an arrangement could considerably improve the performance of the IF amplifier — especially when using the older type 34 tube, which has only about half of the gain of the 1C4.

Another feature you may have noticed is 'grid leak detection' in both the converter and regenerative IF/detector stages. This provides a small amount of bias at the grid of the 32s without the need to involve the grid bias battery and the risk of stray coupling from the IF or local oscillator.

By the way if anyone has either a Healing model 34 or 44B which they would like to see go to good home, would they kindly contact the author.

Another regenerative IF

With the onset of the internet (and a corresponding offset of commonsense and money), many American radios are being added to Australian collections after being purchased through 'eBay'. The small Philco cathedral model 80 is a typical example. The cabinet of this set with the chassis removed is shown in Fig.3.

The four valves and the three coil cans are clearly shown. The valve lineup includes types that were not widely used in Australia — for example the first of the 6.3-volt series types 36 and 37.

In the Philco model 80, a type 36 is used as an autodyne mixer, and the oscillator arrangement is much as the Healing model 44B; that is the oscillator coil is energised from a 100pF trimmer directly from the plate of the 36, and the primary of the IFT is again untuned.

There is only one IFT in this receiver and no separate IF amplifier. The IFT with its tuned secondary is the input to the regenerative second detector, which again uses a 36 with grid leak biasing and regeneration feedback from the plate via a series trimmer. The audio output from the detector feeds a type 42 in the output stage.

A bench test of this receiver was very disap-

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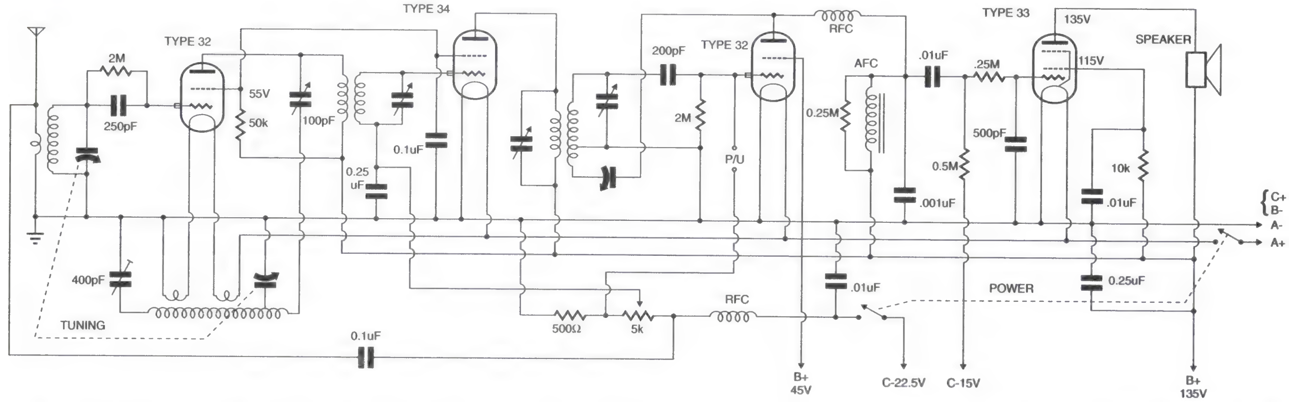


***Fig.2:** The Healing model 44B battery set, a somewhat anachronistic 1934 superhet with a regenerative detector.*

pointing. Selectivity was reasonable, but the sensitivity was woeful. This is despite the receiver supposedly having been 'electrically restored'. Perhaps the trimmers were wiggled loose in transit!

The factory notes for this set make interesting reading. To quote:

The schematic diagram will indicate that regeneration is employed in the circuit of the second detector. Regeneration is controlled by the throttle condenser (18) which may be adjusted from the back of the chassis.

It occurs to us that some over-zealous fellows may make this adjustment too critical, instructions to the contrary, with the possibility thereof of calls from owners complaining of birdies in their sets.

If the adjustment of the regeneration is too critical, a change in the weather may be sufficient to cause the second detector to spill over into oscillation.

So if you get any birdie complaints, remember condenser (18) and dive for it. (So there!)

Editor's nightmare

In the April 1, 1932 issue of *Wireless Weekly* there appears the circuit shown in Fig.4, with a caption describing it as 'the technical editor's nightmare'. Whilst it may have been an April Fool's Day gag, it appears not to be, for the discussion was continued for several issues thereafter. Evidently, an after-dinner discussion took place between the magazine's technical editor and one Mr Barry of Philips Lamps, described as 'a theorist in the extreme sense of the word'.

Would it work? It probably would, but to quote the text 'it seems to us that the circuit is quite practical, but the advantages do not warrant the amount of trouble which would have to be expected to get this job in ship shape form'.

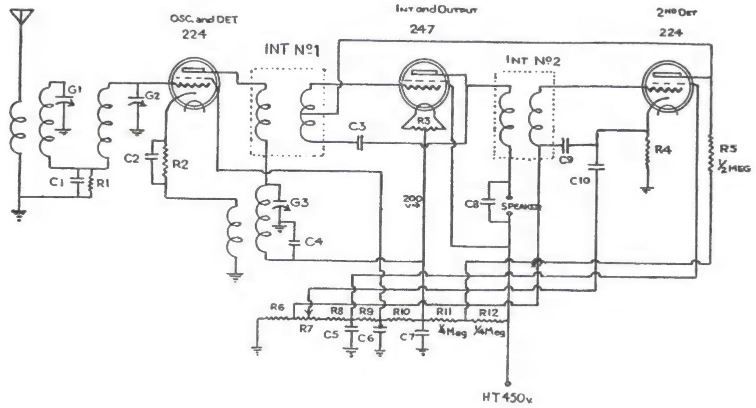


***Fig.4:** Was this design the reflex to end all reflexes? Published in Wireless Weekly for April 1, 1932, it's a superhet with IF reflexing around the Loftin-White audio amp stages.*

To start with, the front end is a preselector tuned by G1 and G2. C1 and R1 were the means of providing adequate and stable coupling of the coils, and typical values were about 5nF and 10k. The first stage is a fairly standard autodyne mixer/oscillator, and the padder is not shown in series with G3.

Now the fun begins. As you can see the first IF transformer stage feeds into the type 47 output valve, used here as a reflexed IF amplifier as well. The IFT is centre tapped, so that it can be neutralised 'with the Rice system'. If you follow the phase relationships of the IF signals through the 47 to the 24A, you will see that neutralisation is necessary.

The audio output transformer (connected to the terminals marked 'speaker') is in series with the primary of the second IFT ('INT No2') and bypassed by C8 (approx 10nF). Next the signal is passed to the 24A anode bend detector and audio amp, which is connected with the 47 in the well-known Loftin-White configuration. The text explains that R5 is the *famous half-meg resistor of the Loftin-White, and the resistor bank R6, 7, 8, 9, 10, 11 and 12 is the normal direct-coupled arrangement with the hum-bucker.*

Not shown is the speaker field, which shunts C7. Otherwise there would be no 200V appearing at the 47 cathode. R7 is purely for hum minimisation; as you can see there is no DC connection between the 24A's cathode resistor and R7.

The biggest problem with this circuit would be getting the voltages correct. The type 47 requires about -16 volts grid bias, which is usually obtained by making the cathode positive to the grid. This means that the anode of the 24A would have to be at precisely 184 volts, which would not be easy with 20% tolerance resistors. When using a type 45 triode as the power tube, the bias is something like -50 to -60 volts, which is much easier to obtain by voltage division using a similar circuit.

The 'RF return' for the secondary of IFT1 would be via C3, the primary of IFT2, C8 and the 2 or 4uF paper filter capacitor at the 450V output from the rectifier. C4 to C7, C9 and C10 are all bypass caps of typically 0.5uF, R10 would be about 12k, and R7, R8 and R9 all about 5k, with R6 having a value of 200-300 ohms.

There is no provision for volume control. This would have to be either by varying the screen voltage of the 47, or completely shunting the antenna input, neither of which is particularly satisfactory.

It makes you wonder why they bothered. Then again, to be fair, these were heady days, and how many circuits which proved to be quite satisfactory started out by doodling and throwing around a few ideas? Either that, or neither gentleman was a total abstainer... ea

INFORMATION **CENTRE**

BY PETER PHILLIPS

Bigger amps, automatic email and that **MP3 project**

This month most of our reader enquiries are about EA projects, and cover typical questions readers have on kit availability, modifying or repairing a circuit and so on. Of course future columns will cover general interest technical topics as well as project enquiries, so keep those letters coming!

Playmaster subwoofer amp kit

Can I still buy a 300W Playmaster subwoofer amplifier kit? These don't seem to be available anymore.

(Geoff, by email)

Jaycar Electronics has recently released a new batch of kits for this 1995 project, but stocks are limited so you'll need to be quick. If these are sold out, try calling Jaycar's Kit Department on (02) 9743 5222. You can also email them at **kits@jaycar.com.au**. Perhaps there might be more kits forthcoming if there's enough demand.

And while we're on the subject of Jaycar kits...

Playmaster Pro Series 3 amplifier kit

I want to build the 1994 Playmaster Pro Series 3 stereo amplifier but it seems that Jaycar no longer sells kits for this project. Do you know of anyone who sells this kit in Melbourne, or if not where I can get the circuit diagrams, parts list and construction guide?

(Craig Hannington, email)

We have been advised that Jaycar is re-instating this kit, so if you have problems getting a kit, contact their kit department as described above. Also, don't forget our reader services in which you can get copies of past issues or photocopies of past projects.

Keyboard, mouse and monitor switch

Has EA ever published a design for an active keyboard, monitor and PS2 mouse switch box? If not, do you know where I might purchase such a device?

(Doug, by email)

Sorry Doug, we haven't published such a circuit, and we don't know of commercial equivalents. As a project, the problem is not so much the circuit, but the large number of PC tracks the circuit would need. While a double-sided board with lots of links could be used, a multilayer board is the only practical solution.

There are however numerous manual switchboxes available, including one from Microgram Computers (**www.mgram.com.au**) that switches keyboard, mouse and video with one thumping great rotary switch. If you needed PS2 switching, simply use an adapter plug.

Oscilloscope card for TV measurements

Is there a commercially available oscilloscope computer plug-in card that has sufficient bandwidth and sensitivity for use in TV servicing and repair? If so, please advise where I might obtain one.

(Frank, email)

National Instruments is one name in 'virtual instruments' who market such a card, and there are undoubtedly others. I suggest you contact Emona Instruments, as they sell cards of this type, and should be able to advise you accordingly. Obviously you want a reasonably high bandwidth (most TV techs use a scope with a bandwidth of 20MHz or better), which will mean you'll also need a pretty fast computer. You can contact Emona on 1800 632 953, or visit the company's website at **www.emona.com.au**.

MP3 desktop player project

You recently stated that you would be featuring an article describing construction of a desktop MP3 player. Has that article been published yet, or if not, when is it likely to appear?

(Peter Knos, email)

At this stage Peter, it seems the contributor of the planned project is so swamped with orders that he hasn't been able to prepare the article describing the project. He is selling ready-built units faster than he can source the components, so he won't be able to supply kits to EA readers until the demand subsides. You can contact him via his website at **www.gigatechnology.com**, but as for the project, hang in there — it will happen, we just don't know exactly when.

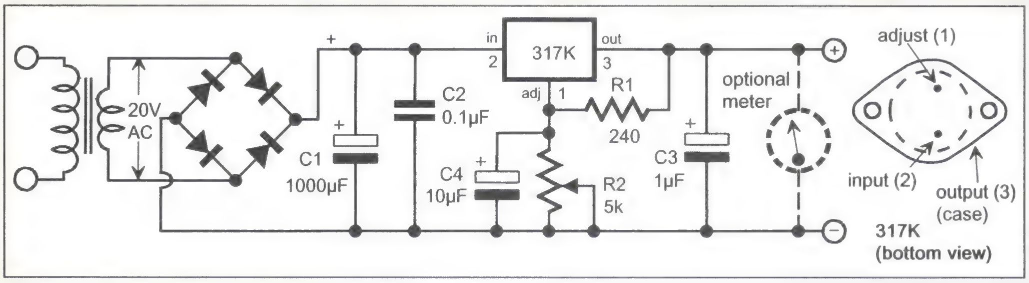
Circuit error in Basic Electronics

What is the correct orientation of capacitor C4 in the regulated power supply circuit in Basic Electronics, Fig.6, page 50? It does not appear on the circuit.

Also can I change the transformer to a 240V-24V 5A type, the regulator to an LM338K (1.2-32V, 5A), and the rectifier to a 6A or 10A bridge? I want to make the supply capable of testing and operating hydraulic solenoid valves that use 12V and 24V DC at 3-4 amps of current. *(Glenn Tuhan, email)*

Thanks for pointing out the omission Glenn. The positive end of C4 goes to the junction of R1/R2, and the negative end goes to ground. That is, as shown in the circuit diagram in Fig.1, C4 goes across the potentiometer.

Yes, you can beef up the components to increase the current, but watch out for the increased heat dissipation. At a current of 4A, the bridge will be dissipating around 5W (1.2V x 4A). More importantly, the regulator will need to be able to handle a power dissipation of up to 80W, assuming a 12V output, a 32V input and a load current of 4A. [Pd = (32V-12V) x 4A.] High current linear power supplies are not simple, which is one of the reasons designers opt for switch mode supplies.



A few gripes with the new *EA*

The following is just one cranky old goat's opinions. I'm referring only the June 2000 issue in which I found a few problems I want to have a go about. The first is the contents page. On page 4 there's a photo of an interesting device with its covers removed and with a caption of 'p93'. There's no description of what the thing is, and I'm not the kind of guy who would turn to page 93 to find out, I'm more likely to curse the inconsiderate absence of a useful caption.

The index to past issues is on page 5. Why? Surely this should be towards the rear of the issue, as otherwise it will become unwieldy. Regarding press releases (pp 6-15), while I have no special gripes, I think it would be real nice if you could screw more pricing details from the vendors.

But perhaps my biggest gripe is the print quality problem on page 41. White text on black background is a courageous move, but my copy is poorly registered (a few mm out) so most of the fine text is broken up and hard to read. Dammit, even the lead paragraph is broken up. And finally, Mr Fist (p46) should take a Bex and have a lie-down.

(Jeff Ralph, via email)

First let's look at the print problem you mention Jeff. We are concerned about this, as our in-house copies are fine. If you would please return your faulty copy, we will replace it with a known good one (and an extra issue with our compliments). We can use your faulty copy to alert the printer to the problem, and hopefully prevent it occurring again.

The contents page with its mysterious caption is aimed more at newsagent browsers than regular readers, as we want them to get interested and buy the magazine. You'll just have to flip to page 93! Regarding the index, are you aware it's a rolling index, in which the oldest items fall off the list to make room for the new ones. Why? Because if you have ever looked for an article, you'll know how frustrating it is to search through EVERY issue to find it.

This way you can search through a whole year in three to four issues. It's up the front so you can easily find it, as you don't want to have to search for an index. As for prices of items in What's New, we agree with you Jeff, as everyone likes to know 'how much', but sometimes the items are so new, they don't have a price yet... Finally, Mr Fist enjoys being a bit outspoken — I think it will take more than a Bex to subdue him.

Colour bars for the Sync Generator?

I have read with interest the June 1997 Composite Sync Generator For TV construction project, which points out that a 'colour bar add-on board' will be published sometime soon. Has this eventuated? If not, is it a simple process to build a colour bar generator for it? *(Dave Chinnery, Perth, WA)*

We intended developing a colour bar board for this project, but this has now been put to one side due to a lack of interest in the project both from kit companies and readers. The most recent colour bar project we've done is the October 1987 TV Colour Bar Pattern Generator, but obtaining parts could be a problem.

Automatic email interface

I'd like to propose two suggestions for projects. The first is a project which automatically sends email from a home PC to an internet email address. Many people have a second PC and a superseded modem which could be set up using some kind of scripting approach to generate an outgoing email, say to a PC at work. Norton Scheduler seems capable of being pro-

grammed to start up a given program, but I don't know how to automatically generate an outbound email. The line could be held open to the ISP with programmed pinging for as long as desired.

I work in a large corporation with Lotus Notes open all day, which allows instant messaging, normally internal, although I often receive emails from outside. As a project, it would be great to receive an email from my unattended home PC to alert me that someone has opened the front door, or more mundanely, that someone has sent an email to my home PC. At an advanced stage, the system could email a JPEG image of various parts of the house so I can check who's home, or it might send sound via a microphone installed in the house.

My second suggestion is for an internet connection interface. On the www.microchip.com website Myron Loewen describes a PIC microcontroller interface to the internet. (Application Note 724 — Using PICmicro MCUs to Connect to Internet via PPP.) This looks to have the lowest cost, and is most likely to actually work given the corporate 'credentials' compared to those of an individual. Possible uses for this could be a means of sending information about the change in the mains current as family members return home, or to tell me that there's messages on the home answering machine. Incidentally the magazine's 'new face' looks great.

(Ian Rowatt, Koolewong, NSW)

Thanks for these suggestions Ian. As it turns out we are currently looking at something along the lines you propose, using a Scenix micro. Stay tuned! Also thanks for the positive comments about the new look *EA*.

Dowloading a video clip from the *EA* website

On page 56 of the May 2000 edition Tom Moffat's article on flying mentions a video clip on the EA website (CS-CRASH.RM) Would you please explain how and or where this can be accessed.

(Geoff Rees, Lara, Vic)

Log on to our website at **www.electronicsaustralia.com.au**, and go to the Free Downloads area. In the search field, enter 'Crash', 'Moffat', 'Airline' or any other identifier. When the search results come back, click on the appropriate link to download the file. If your browser insists on *displaying* the file, select 'Save this link as' or equivalent, depending on your browser and computing platform.

Automotive injector tester

Has EA ever published an injector tester for automotive applications? I'm after something that could test at least six injectors at one time.

(David Pressley, email)

Sorry David, but we haven't published such a design. I imagine it would be a reasonably demanding unit to develop, but nevertheless we'll keep it in mind for the future.

Versatile Subwoofer Adapter

I'm writing to ask a question about the May 1989 Versatile Subwoofer Adapter. I know it's an old project, but it might suit my needs. Is there any modification needed to use it with the pre-out jacks you find on stereo equipment? I've just purchased a new Dolby digital decoder and want to use it for the LFE channel, however the connection to the speakers, as per the article, would limit this.

(Damian Price, email)

The May 1989 subwoofer adapter could be modified with a degree of messing about, but to be honest Damian, I think the Sub-bass Processor from the September '99 issue would be more useful — and wouldn't need any modification. This project is still available in kit form, and as a bonus includes variable equalisation to get the best from your subwoofer.

600W Subwoofer amplifier

Has EA designed an amplifier that is more powerful than the Playmaster 300W Subwoofer Amplifier? I would like an amp capable of around 600W RMS into 8 ohms (two channels). Also the crossover on my Playmaster amplifier is not working. I have checked all capacitors, transistors and diodes but I'm not sure about the resistors and ICs.

(Daniel, email)

That's about the biggest amp we've done Daniel, as they get very expensive as the power goes up past the 300W point. The first thing to check on the crossover is that the power supply sections are working correctly. The crossover has its own independent supply, which should produce +/-16V (or thereabouts) on the crossover board — this ultimately powers the opamps at pins 4 and 8. ea

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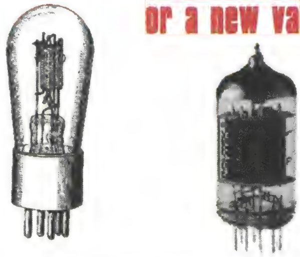

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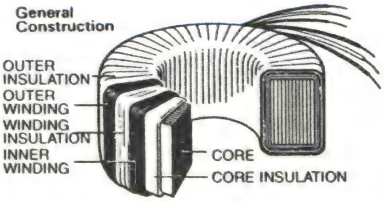

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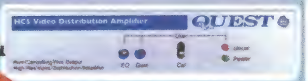

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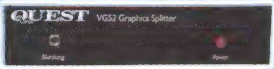

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BY OWEN BISHOP

Lap timer

This month's project is an add-on to last month's Reaction Timer. If by now you have tried measuring your own reaction time and have found which of your family and friends is the fastest, you can make the conversion for little extra cost. You will still be able to use it as a reaction timer.

PARTS LIST

(This is for the lap timer extention — see the September 2000 issue for the Reaction Timer parts list and construction details.)

resistors

R7	Light dependent resistor, ORP12 or similar
VR2	100k horizontal miniature trimpot

capacitors

C1	100uF electrolytic, radial leads

semiconductors

IC4	4027 dual J-K flipflop

miscellaneous

16-pin IC socket

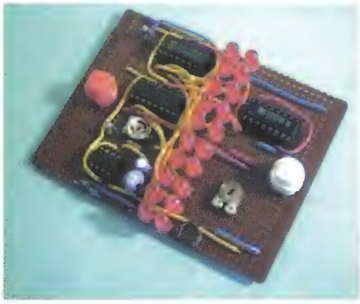


***Fig.1 (right)**: The 4027 J-K flipflop toggles in response to changes in the level of light falling on LDR R7.*

THE youngest members of our family have just been given a radio controlled Buggy. Driving it round the patio without it falling in the pool (luckily, its covered with a net) is a severe test of skill. Now they can aim one higher, and try for record times with this Lap timer. You can use it with model racing cars too, and also measure the running or cycling lap times of your long-suffering friends and family.

How it works

If you remember from last month, the Reaction Timer is driven by a 100Hz clock. It has two decade counters connected in cascade, and these drive a display consisting of two rows of LEDs. The upper row indicating hundredths of a second while the lower row indicates tenths. As a lap timer needs to measure longer intervals, so we slow the clock down to 1Hz. Now the rows represent seconds and tens of seconds respectively. Thus, the timer measures lap times in the range 1 to 99 seconds.

Normally, the display of the Reaction Timer is started and stopped by two push buttons, but the Lap Timer uses an optical trigger. In the Reaction Timer, the Enable inputs of the counters were connected to 0V, to enable the chips permanently. This left the start and stop control to the two buttons. As shown in Fig.1, the Enable inputs are now used to start and stop the display. They receive a logic level from IC4, which is a 4027 J-K flipflop (Fig.3).

A flip-flop is a circuit that can exist in two states, with its output either at logic high or at logic low. Which state it is in depends on what inputs it has received. The 4027 flip-flop is an example of *clocked logic*. It is controlled by the state of its J and K inputs, but not immediately. The J and K inputs may change, but nothing happens until the clock input goes from low to high.

In this project, we do not change the J and K inputs. They are permanently wired to the positive supply. If both J and K are high, the output (Q) toggles (changes state from low to high or from high to low) every time the clock input goes from low to high. Note that there is no change when the clock input goes from high to low.

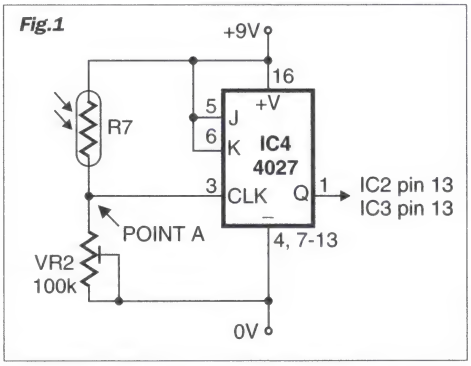
The clock input of IC4 does not have to come from an actual clock. Here it comes from a potential divider made up of a light dependent resistor (R7) and a trimpot (VR2). The trimpot is used to adjust the circuit for working with different lighting. For indoor use, you would usually have a desk lamp shining on the LDR from about a metre away. You could also use an electric torch, or possibly a laser pointer. When the LDR is fully illuminated, its resistance is low (often less than 1k) so the voltage at point A in Fig.3 is more 4.5V, perhaps as high as 8V.

If the beam of light is broken, for instance by a passing buggy, the resistance of R7 increases sharply. Depending on the type of LDR, the resistance may rise to 5k or more. The voltage at A falls below 4.5V, perhaps to only a few hundred millivolts. So, if a car is in the beam and then moves out of it, the voltage at A changes from low to high. This triggers the flip-flop and its output changes state. If it was high before, it is low now, which means that if IC2 and IC 3 were disabled before, they are enabled now. Each time the beam is broken and then restored, the flip-flop changes state and the display changes from not-counting to counting or the other way about. It is at the instant of restoring the beam that counting starts or stops.

The procedure for timing a lap is simple. Start with the display not counting. If it is counting already, stop it by passing your hand quickly through the beam. Reset the counters by pressing S1. The count starts again the next time the beam is broken and restored.

If the car is lined up on the starting line and is already breaking the beam, counting begins as soon as the car drives off. Alternatively, you can start the car some way back and counting starts

Fig.1



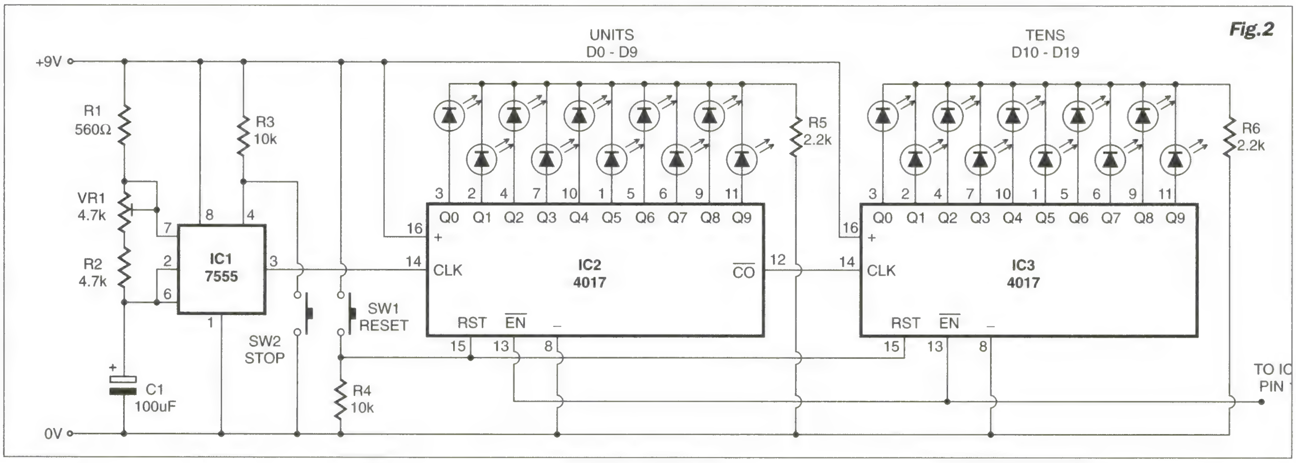


Fig.2

***Above**: Last month's timer/display circuit is now controlled by the light detector shown in Fig.1 - presto, instant Lap Timer!*

as soon as it drives through the beam. As the car completes the lap and breaks the beam a second time, counting is stopped. Read the lap time in seconds and ten of seconds from the display.

Construction

Instructions for building the Reaction Timer were given last month. Please refer to these if you have not already built it. If you are starting from scratch this month and want to go straight to the lap timer, follow the instructions given last month, but omit C1 and R4. Also, omit the wires connecting pin 13 of IC2 and IC3 to the 0V rail.

If you have already built the Reaction Timer, or have started this month as described above, the conversion steps are as follows:

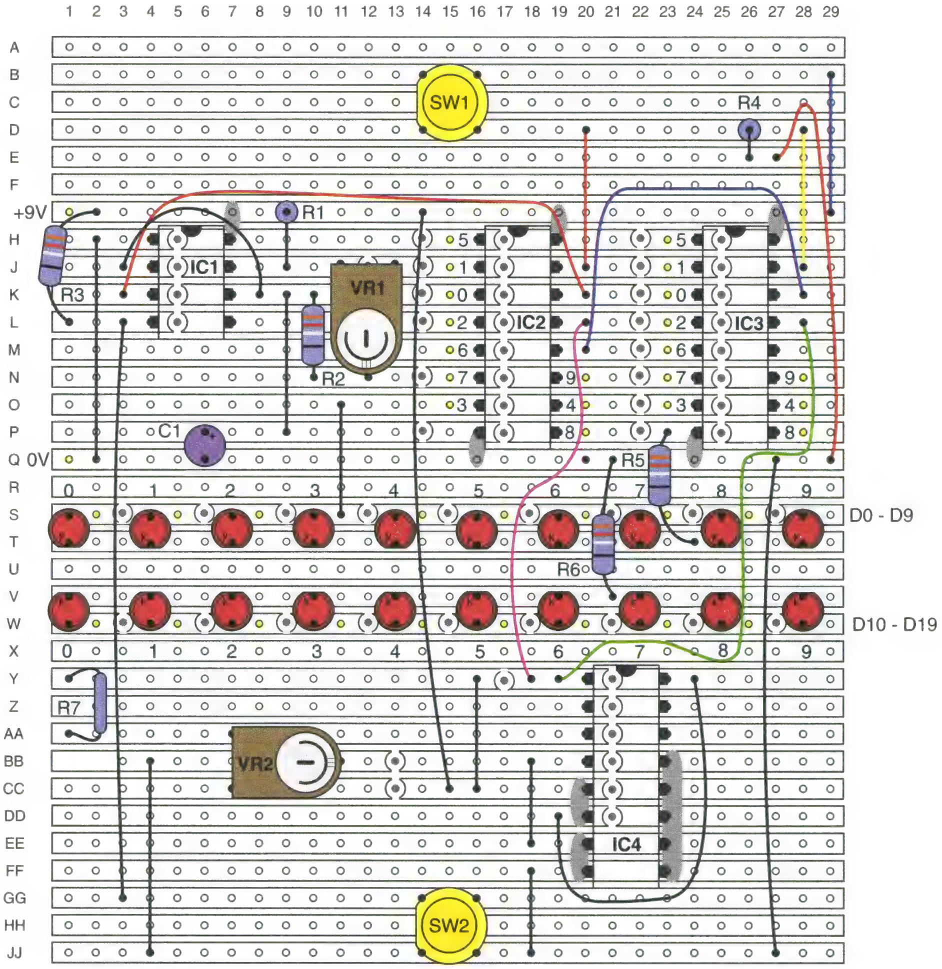
1: Timing capacitor: This is now 100uF instead of 1uF. You can replace the original C1 with the new one of higher capacitance or, if preferred, simply solder the new capacitor in parallel with the original one. If you still want the circuit to operate as a Reaction Timer, you will need to be able to put either capacitor into the circuit.

Try Soldering the two side by side with their negative terminals to the 0V rail. Solder their positive terminals to adjacent rails and solder a terminal pin in each rail. Then you can connect either capacitor with a flying lead from pin 6 of IC1, ending in a crocodile clip. Check the underside of the board to see if any strips should be cut to isolate the new components.

2: R7, VR2 and IC4: Fig.2 shows the wiring, which occupies the lower area of the board. The LDR is mounted on the left edge of the board, but you may prefer to mount it remotely and run a lead to the board. This part of the circuit needs a connection to the positive supply rail. It is also connected to the 0V rail on the lower edge of the board.

Note that IC4 contains two flip-flops of which we use only one. All unused inputs must be grounded, which is why there is a long solder blob connecting pins 9 to 13, as well as two smaller blobs (5-6 and 7-8) on the left side. The strips are NOT cut between pins 7 and 10 and between pins 8 and 9.

(Continued on page 97)



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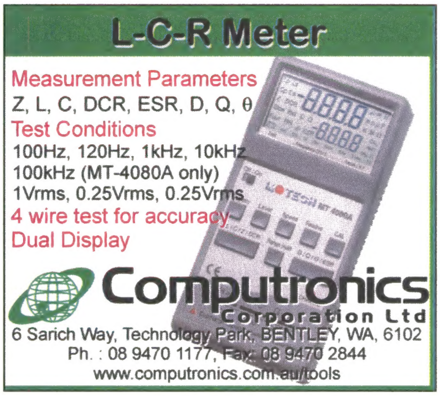
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Within the central chamber, which is also magnetically shielded, there's a surrounding coil system which produces a weak but adjustable axial magnetic field. There's also a U-shaped microwave cavity, the so-called 'Ramsey cavity', into which the 9.19263GHz energy is fed from the frequency synthesiser system. The cesium beam passes through this cavity twice, through pairs of holes near each end of the 'legs' of the U. This allows maximum interaction between the atoms and the microwave energy, with no more than a small amount of energy needed.

At the far end of the vacuum chamber, where the beam emerges, a second selector magnet system is used to again separate the atoms into two streams — those that have been 'flipped' into the second energy level, and those that haven't. The latter are simply discarded, while the wanted atoms are directed to a hot-wire ioniser to give them an electrical charge, preparing them for detection. Finally they're passed to a mass spectrometer (for final 'filtering') and and electron multiplier detector system, which produces a current proportional to the number of atoms which were 'flipped' between the two energy levels by the microwave energy.

It's the output from the tube's detector which is used to generate the error feedback signal which locks the crystal oscillator to the correct frequency for the peak in beam current, corresponding to a microwave signal of exactly 9.192631770GHz. And because of the way the frequency synthesiser works, when the microwaves fed to the cesium-beam tube are at this precise frequency, the crystal will also be locked to exactly 10.000000MHz — with an absolute accuracy of typically better than one part in 1012.

Once you have a signal locked to this very accurate frequency, it's relatively easy to use it to produce very accurate time signals. Divide it down by 10 million and you have 1Hz pulses to drive a clock movement or digital clock counter, for example. And once that clock readout is set to the correct time, it'll take a very long time before any errors become noticeable, even in comparison with other atomic clocks.

There are various other types of atomic clocks, including the cesium fountain type, the rubidium-vapour type and the hydrogen maser. However this look at the cesium-beam type should have given you at least a basic idea of the way they work. **ea**

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3: Enabling connections: Wires run from pin 1 of IC4 up to pin 13 of IC2 and IC3.

4: R4: the change in the connection to IC2 pin 13 means that this resistor loses its connection to the 0V rail. It is now relocated to the top right corner of the board, with an additional wire connecting it to the right end of the 0V rail.

Testing the clock and display is described in last month's issue. The optical trigger circuit is tested after setting up a lamp to shine on the LDR. Monitor the voltage at pin 3 of IC4. Adjust VR2 so that the voltage is well above 4.5V (usually about 6V). When the beam is broken the voltage falls to about 1V. Now check the output from pin 1, which shouldn't change when the beam is broken. It should, however, change from 0V to 9V (or the other way round) whenever the beam is restored. Sometimes you may find that stray light upsets the action of the optical trigger. If so, make a small card shield to cover R7, leaving it exposed only to light from the lamp.

Now that the wiring on the board has increased, you may find that there is interference between one part of the circuit and another. This shows up as irregularities in the counting, such as skipping a count. Another thing that may happen is that the flip-flop may change and the change back immediately.

These faults did not occur on the prototype but if they are a problem to you, first check the wiring carefully. Look for short-circuits caused by blobs of solder. Also, look for incorrect connections. If the trouble persists, try decoupling the supply to each of ICs 2, 3 and 4 by soldering a 100nF greencap across their supply pins. In each case, solder the terminal wires of the capacitor as close as possible to the positive supply pin (pin 16) and the 0V pin (pin 8). **ea**

NOTES & ERRATA

FLEXIBLE SOLID STATE VOICE RECORDER (August 2000): Some recorders have proved a little noisy, and the noise appears to be caused by oscillation at a supersonic frequency. This can be solved by connecting a 100uF/16VW electrolytic capacitor across the PWR inputs on the board (next to JMP8). Make sure you observe the correct polarity.

SPINFX (March 2000): It has come to our attention that some of the Spinfx kits available from Dick Smith Electronics have a track bridge on the spinning PCB due to a problem in manufacture.

The bridge, which is only present on some boards, occurs on the top layer from the pin 9 pad of the PIC16F84 to the track running 'from pin 8. Before assembling the circuit test to see if there is a short present between these two pads using a multimeter. Alternatively visually inspect the pad using a magnifying glass for a fine bridge as shown in this diagram. If the bridge is present use sharp a knife to cut it away. Check to see that it is properly removed before assembling. If not removed it will cause the red and orange LED banks to not illuminate.

If the kit has been assembled and is experiencing these problems then the IC socket can be removed (difficult) and the bridge cut. Alternatively the pin 9 track can be cut and pin 9 of the IC bent out so that it does not connect with the socket contact. Then solder a wire to join the IC pin to the track after the cut. Apologies for any inconveniences caused.

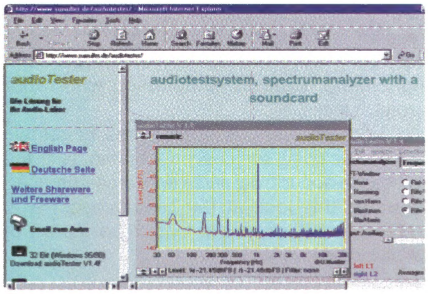
For more detailed information, visit www.sautec.com.au/spinfx.htm. **ea**

WEB WATCH

BY DARREN YATES

Scanning the software spectrum...

WHILE A GOODLY portion of sound cards I've looked at over the last few years make more noise than a off-tuned AM radio station, choose the right card and you have the beginnings of a very useful bit of test gear.


audioTester
Die Lösung für die Audio-Labor
audiotestsystem, spectrumanalyzer with a soundcard
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Email zum Autor
32 Bit (Windows 95/98)
Download audioTester V1.4
audioTester

Some of the better sound cards offer signal-to-noise ratios (SNR) of close to -85dB and total harmonic distortion figures of below 0.01 percent — that's better than some test instruments, including HP's sterling 334A audio distortion meter.

The only problem is that there are so few shareware tools that allow you to use your sound card as an audio measuring device. One that rates as a definite 'must-see' is this German software called AudioTester (**www.sumuller.de/audiotester**) — it's by no means pretty and doesn't rate for artistic quality as an Audio Precision box, but it's quite effective. It allows you to measure THD, SNR as well as using your sound card as a decent audio signal generator.

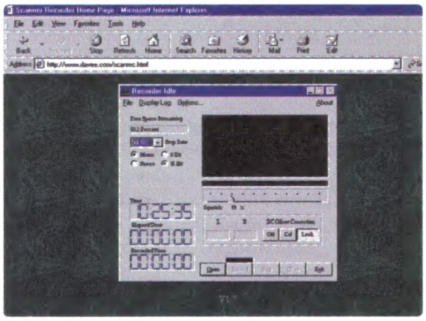
Compared with some of the prices being asked for this kind of software, AU$50 seems quite cheap.

SOMEONE ONCE SAID that in order to know where you're going, you need to remember where you've come from. I guess that's why I enjoy reading up on the history of electronics.

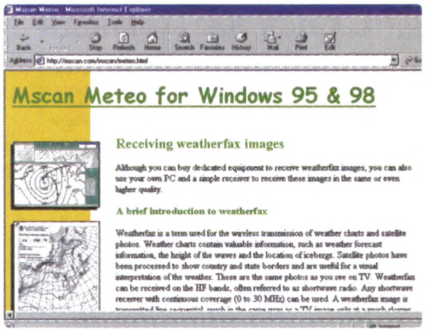
One of the most interesting periods was the turn of the 20th century — we went off to war and for the first time, electronics began to play its role. You can read up on the history of radio in the US from 1900 to 1927, which includes early valve development and how governments struggled to legislate new technology (funny how things don't seem to change much) in a collection of interesting articles found at **www.ipass.net/~whitetho**.

IF YOU'RE INTO amateur radio, you've probably spent hours sitting next to your receiver monitor the airwaves. Rather than spend all of your time listening to static, why not get your computer to monitor for you?

Unfortunately, most audio software programs just go hell for leather when you start them up and can chew through a hard disk drive in pretty quick time. Scanner Recorder (**www.davee.com/scanrec.html**) is a neat handy little tool that only records incoming signal once it's above a user-defined threshold — you only get the signal you want. It's a tiny program, runs on any old 486 and best of all — it's free!


Scanner Recorder Home Page - Microsoft Internet Explorer
http://www.davee.com/scanrec.html
Recorder Idle
File Display/Log Options...
About
02:35:35
00:00:00
00:00:00

WHILE WE'RE on the subject of amateur radio, I've always been intrigued by the idea of sending TV signals via audio — and that's what SSTV (slow-scan television) is all about. It used to be quite big about 30 years ago but thanks to the low-cost computer hardware we now have, it's been undergoing a renaissance in the last few years.


Mscan Meteo - Microsoft Internet Explorer
http://mscan.com/mscan/meteo.html

Mscan Meteo for Windows 95 & 98

Receiving weatherfax images

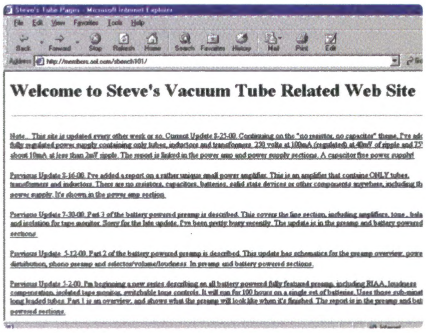
Although you can buy dedicated equipment to receive weatherfax images, you can also use your own PC and a simple receiver to receive these images in the same or even higher quality.

A brief introduction to weatherfax

Weatherfax is a term used for the wireless transmission of weather charts and satellite photos. Weather charts contain valuable information, such as weather forecast information, the height of the waves and the location of icebergs. Satellite photos have been processed to show country and state borders and are useful for a visual interpretation of the weather. These are the same photos as you see on TV. Weatherfax can be received on the HF bands, often referred to as shortwave radio. Any shortwave receiver with continuous coverage (0 to 30 MHz) can be used. A weatherfax image is

Mscan (**http://mscan.com**) looks to be one of the better packages on the web — it not only captures SSTV signals but it will also handle weather-fax transmissions too. Here's a new way to get your computer in onto your amateur radio hobby.

VALVES ARE very definitely on the way back in (for some of us, they never really left!) and there's now a truckload of information about building amplifiers and other circuits on the Internet — a good portion of the info is excellent stuff but there's also quite a deal of rubbish being trotted out by people who seem to travel from one fad to the next.


Steve's Tube Pages - Microsoft Internet Explorer
http://members.aol.com/sbench101/

Welcome to Steve's Vacuum Tube Related Web Site

Note... This site is updated every other week or so. Current Update 8-25-00. Continuing on the "no resistor, no capacitor" theme, I've ad fully regulated power supply containing only tubes, inductors and transformers. 230 volts at 100mA (regulated) at 40mV of ripple and 75 about 10mA at less than 2mV ripple. The report is linked in the power amp and power supply sections. A capacitor free power supply!

Previous Update 8-16-00. I've added a report on a rather unique small power amplifier. This is an amplifier that contains ONLY tubes, transformers and inductors. There are no resistors, capacitors, batteries, solid state devices or other components anywhere, including th power supply. It's shown in the power amp section.

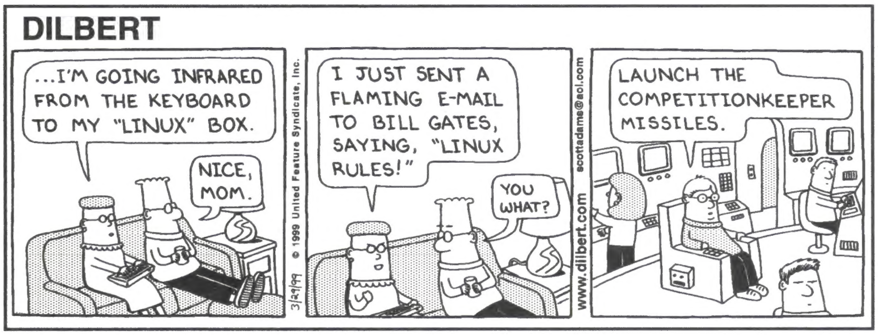
Previous Update 7-30-00. Part 3 of the battery powered preamp is described. This covers the line section, including amplifiers, tone, bala and isolation for tape monitor. Sorry for the late update. I've been pretty busy recently. The update is in the preamp and battery powered sections.

Previous Update 5-12-00. Part 2 of the battery powered preamp is described. This update has schematics for the preamp overview, powe distribution, phono preamp and selector/volume/loudness. In preamp and battery powered sections.

Previous Update 5-2-00. I'm beginning a new series describing an all battery powered fully featured preamp, including RIAA, loudness compensation, isolated tape monitor, switchable tone controls. It will run for 100 hours on a single set of batteries. Uses those sub-mini long leaded tubes. Part 1 is an overview, and shows what the preamp will look like when it's finished. The report is in the preamp and bat powered sections.

Steve Bench isn't one of the latter — and his web site is full of quality useful information you won't find to many other places on the web, info from valve microphonics to building unusual amps that have a tone all of their own.

The site isn't pretty but who cares — so long as it's worthwhile, a plain text web site doesn't worry me. Head over to **http://members.aol.com/sbench101**. ea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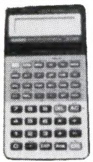

SCIENTIFIC CALCULATOR
CASIO FX-D400, 16 digit, dot matrix LCD displays alpha characters along with values and indicators, has replay function, large quantity: $26

DIARY - ORGANIZER
CASIO JD-5000BK "My Magic Diary", displays messages in one of 5 languages, English / Italian / Spanish / German / French. Modes of operation include include Telphone Directory, Schedule, Calendar, Data Memo "Diary", Secret Memory area, Time keeping, Alarm, Fortune Telling, Conversion, Calculator, Data Communication. Has an easy to understand main menu with simple icons, good quantity: $20

SCIENTIFIC CALCULATOR
CASIO FX-350D, 8+2 digits, huge quantity: $15Ea., buy 10 or more for $13.50 Ea.

MORE CALCULATORS ON OUR WEB SITE

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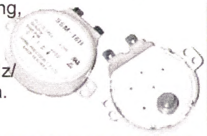

BRAND NEW GERMAN MADE MOTOR AND GEARBOX.
This is a 24V motor but runs well with plenty of torque at 12V & starts at 2-3V. The shaft is 10mm dia. & the motor is 60mm dia. X 94mm long. We think they were made as truck windscreen wiper motors. This motor is worth over $100, But as a special for Aug.& Sep.2000 only... just $20

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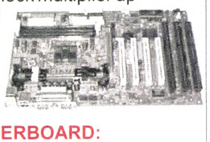

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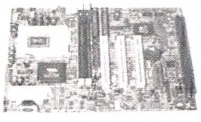

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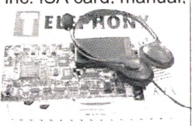

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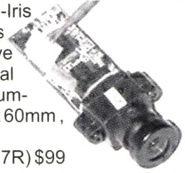
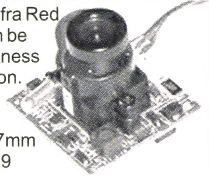


HIGH PERFORMANCE MONOCHROME CCD CAMERA MODULE: Operates from 7.5 to 14.5V DC (1.16W) & outputs CCIR (50Hz, 625 lines interlaced) composite video (1V pp 75ohm). Horizontal resolution is 380 TV lines, CCD element size is 1/3", light sensitivity is 0.1Lux. Has Auto-Iris lens. This camera is Infra Red responsive & can be used in total darkness with IR Illumination. 32mm squ. x 27mm high. 20grams. Inc. 3.7mm lens: (AR732) $89



COLOUR CCD CAMERA MODULE WITH AUDIO: Operates from 12V DC (2W) & outputs PAL (50Hz, 625 lines interlaced) composite video (1V pp 75ohm). Horizontal resolution is 330 TV lines, CCD size is 1/3", light sensitivity is 3Lux. Has Auto-Iris lens. 38mm x 38mm x 32mm high and unit weighs 20grams. Inc. 3.7mm lens: (ARCB21) $180

HOUSED MONOCHROME CCD CAMERA: Operates from 12V DC (1.16W) & outputs CCIR (50Hz, 625 lines interlaced) composite video (1V pp 75ohm). Horizontal res. is 380 TV lines, CCD size is 1/3", light sensitivity is 0.1Lux. Has Auto-Iris lens. This camera is Infra Red responsive & can be used in total darkness with IR Illumination. 40mm x 39mm x 35mm high & unit weighs 13g (AR830M) $99

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B & W Camera is built on a small PCB with an auto iris lens. (IR) responsive. (0.1 lux) Can be used in total darkness with IR Illumination. 32 x 32 by 27mm. The output is std video & can be plugged into the "VIDEO IN" socket of any Australian std VCR, video monitor or TV, or via an RF Modulator to an Antenna Input. The lens can be focused sharply down to a few mm(this is useful for people with visual impairment). Spec.: Power req.: 10V to 12V @ approx. 50mA. Resolution: 400 lines approx. CCD sensor : 1/3" (320 000 pixels). Weight: 30g: Version with 60° (Pin Hole) lens fitted: (CA41L60) $89, with 92° lens: (CA41L92) $89, with 120° lens:(CA41L120) $89, with 150° (Fish Eye lens) (CA41L150) $99

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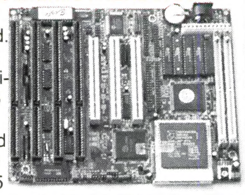

FLIGHT FORCE PC JOYSTICK:
This analogue joystick features 4 fire buttons - with disable function for 2 player compatibility, comfortable contoured handgrip, auto cantering, independent auto-fire and X & Y axis trim controls. Also has a durable metal base with a large suction cup for stability. This item is new and supplied in its original retail box: (ZA0098) $25

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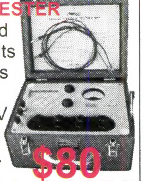

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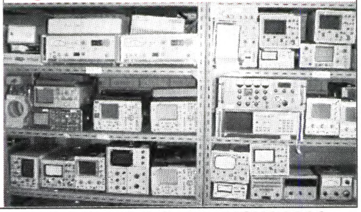

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